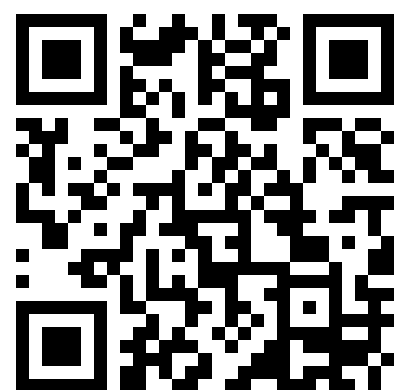
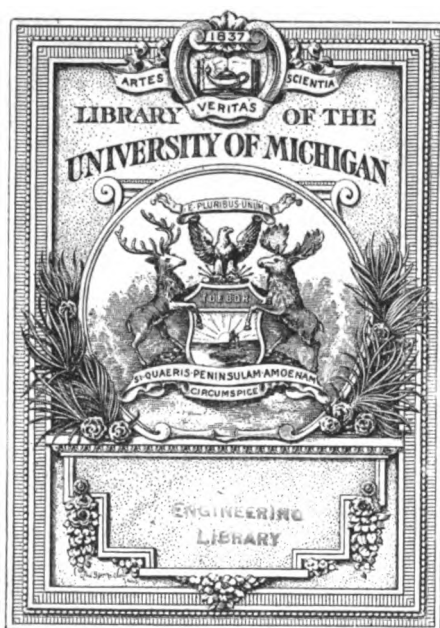

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A JOURNAL for the ARCHITECT, ENGINEER, MECHANIC and MUNICIPAL OFFICER

CONDUCTED BY HENRY C MEYER.

INDEX TO VOLUME XVI. 29693

JUNE 4, TO NOVEMBER 26, 1887.

82 & 84 Fulton Street, New York.

London Office, 92 & 93 Fleet Street.

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Consolidated Safety-Valve Co., 111 Liberty St., New York.
Crane Bros. Mfg. Co., Chicago, Ill.
Crosby Steam Gauge and Valve Co., 95 Oliver St., Boston.
Kelly & Jones, 75 John Street, New York.
Timothy Kieley, 7 West 13th Street, New York.
Thomas L. McKeen, McKeesport, Pa.
Pancoast & Maule, 243 South Third Street, Philadelphia.
Rutzler & Blake, 176 Centre Street, New York.
Walworth Mfg. Co., 16 Oliver Street, Boston.

STEAMSHIPS.

Cunard Steamship Co., 4 Bowling Green, New York.

SHUTTERS—Iron and Wood.

Dodd Manufacturing Co., 19 Park Place, New York.
Clark, Bunnell & Co., 162-164 W. 27th Street, New York.

SASH WEIGHTS—Lead.

J. N. Raymond, 55-57 Lake Street, Chicago, Ill.

SKYLIGHTS.

Geo. Hayes & Son, 71 Eighth Avenue, New York.
Knisley & Miller, 129-131 S. Clinton Street.

SMELTING FURNACES.

The Hartsfield Portable Smelting Furnace Co., Newport, Ky.

STONES—Building.

Chris Binder & Sons, East Blue Hill, Me.
M. H. St. John, 265 Broadway, New York City.

STOVES.

Omega Stove and Grate Co., 89 Euclid Avenue, Cleveland, O.

SINKS.

Kilbourne & Jacobs Mfg. Co., Columbus, O.

SEWER PIPE—Drain and Culvert.

American Sewer Pipe Co., Akron, O.
Blackmer & Post, 325 Chestnut Street, St. Louis.
Calumet Fire-Clay Co., Calumet, O.
Empire Fire Clay Co., Empire, O.
Jackson Bros., Albany, N. Y.
Pennsylvania Manufacturing, Mining, and Supply Co., 1004-1008 Penn Avenue, Pittsburg, Pa.
H. A. Warner, New Haven, Conn.

TRAPS—Sewer Gas.

James Barrett, 207 Tremont Street, Boston.
B. P. Bower, Cleveland, O.
N. Barry & Son, Muscatine, Iowa.
F. E. Cudell, 204 Superior Street, Cleveland, O.
DuBois Mfg. Co., 245 Ninth Avenue, New York.
Erie City Foundry, Erie, Pa.
New York Sanitary Mfg. Co., 273 Pearl Street, New York.

TESTING MACHINES—Cement.

Riehle Bros., 50 South Fourth Street, Philadelphia, Pa.

TILES.

American Encaustic Tiling Co., 116 W. 23d Street, N. Y.
A. Booth, 11 East Nineteenth Street, New York City.
Miller & Coates, 279 Pearl Street, New York.

TERRA COTTA.

Boston Architectural Terra Cotta Works, 384-390 First Street, Boston.
Pennsylvania Manufacturing, Mining and Supply Co., 1004-1008 Penn Avenue, Pittsburg, Pa.
Trenton Terra Cotta Co., Trenton, N. J.

TRENCH EXCAVATING MACHINES.

H. A. Carson, 21 Hamilton Street, Boston.

VARNISHES.

John L. Armitage, Newark, N. J.

VENTILATORS.

E. Van Noorden, 380 Harrison Avenue Boston, Mass.

WARMING APPARATUS.

E. P. Bates, 59 W. Water Street, Syracuse, N. Y.

VALVES—Water, Gas, and Steam.

Chapman Valve Co., Indian Orchard, Mass.
Consolidated Safety-Valve Co., 111 Liberty St, New York.
D'Este & Co., Boston.
Frontier Iron and Brass Works, Detroit, Mich.
Galvin Brass and Iron Works, Detroit, Mich.
Hay & Prentice, Chicago.
Holland & Thompson, Troy, N. Y.
Ludlow Valve Mfg. Co., Troy, New York.
Mason Regulator, 22 Central Street, Boston.
T. R. McMann & Bro., 56-60 Gold Street, New York.
H. Patterson, Albany, N. Y.
Peet Valve Co., 163 Albany Street, Boston.

WATER-METERS.

National Meter Co. ("Crown"), 252 Broadway, New York.
S. A. Strang ("Deacon"), 30 Pine Street, New York.
Water-Waste Prevention Co. ("Thomson"), 143 Nassau Street, New York.
H. R. Worthington ("Worthington"), 86 Liberty Street, New York.

WINDMILLS.

A. J. Corcoran, 76 John Street, New York.

WIRE CLOTH.

Clinton Wire Cloth Co., 59 Beekman Street, New York.
New Jersey Wire Cloth Co.
Taylor & Dean, 205 Market Street, Pittsburg.

WATER AND GAS WORKS BUILDERS.

Water and Gas Works Construction Co., 48 Wood Street, Pittsburg, Pa.
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WATER-WORKS MACHINERY.

Pond Engineering Co., St. Louis, Mo.

WOOD STAINS.

Berry Bros. (Oil Finish), Detroit, Mich.
Samuel Cabot, 70 Kilby Street, Boston.
Walpole Dye and Chemical Works, Boston.
Dexter Bros., 55 Broad Street, Boston.

WOOD-WORK—Interior, Cabinet, etc.

George A. Schastey & Co., 53d Street and Broadway, N. Y.
Springfield Wood-Working Co., 5 East 17th Street, N. Y.

VOLUME FIFTEEN.

(December, 1886—June, 1887.)

This handsome volume is a complete illustrated record of subjects coming within the scope of this journal—Engineering, Architecture, Construction, Sanitation, and related subjects in which municipal problems are a prominent feature. It is a very complete record of weekly events, and also contains a number of special articles of permanent value to all who are interested in the subjects treated.

Among the more notable topics and articles are—

Full-page Architectural Illustrations—

The Memorial Hall of the School at Lawrenceville, N. J., Peabody & Stearns, architects.
Residence at Saratoga, A. Page Brown, architect.
Residence at Narragansett Pier, Douglas Smyth, architect.
A Welsh Shooting-Box and Village, to be submerged on completion of the Vyrnwy Dam.
A residence at Manchester, Mass., Arthur Little, architect.
Commercial Buildings in Philadelphia and Washington, James P. Sims and Hornblower & Marshall, architects.
Views in Old Edinburgh, from the International Exhibition of 1886.
A residence in Philadelphia, T. Roney Williamson, architect.
A Fire-Place in a New York residence, McKim, Mead & White, architects.
A residence in St. Paul, Minn., Gilbert & Taylor, architects.
Depots at Waban and Woodland, Mass., H. H. Richardson, architect.
A hotel in Florida, Frederick B. White, architect.
A house in the English lake region.
Entrance to the Memorial Hall of the School at Lawrenceville, N. J., Peabody & Stearns, architects.
Memorial Bridge to General Grant over the Potomac River, Captain Thomas W. Symons, U. S. Engineers, and Smithmeyer & Pelz, architects.
Home for the Relief of the Destitute Blind in New York City, F. Charles Merry, architect.
A residence in Jamaica Plains, Mass., E. M. Wheelwright, architect.
Stations on the Boston and Albany Railroad, H. H. Richardson, architect.
A residence in Newport, R. I., George B. Post, architect.
Residences in Boston, Rotch & Tilden, architects.
A residence in Cohasset, Mass., W. R. Emerson, architect.
A Commercial Building in New York City, John H. Duncan, architect.
A residence in Beverly, Mass., H. H. Richardson, architect.
A residence in Hackridge, England, R. Creed, architect.
A residence in Newport, R. I., McKim, Mead & White, architects.
A Railway Depot at Mott Haven, N. Y., R. H. Robertson and A. J. Manning, architects.
Church of St. James the Less, Falls of the Schuylkill, Pa.

Also Drawings to Scale of Details of—

An Old Doorway in Boston.
The Pineapple House in Salem.
An Old Colonial Entrance in Charleston, S. C.
A Store Front in New York City.
Doorways of Houses in Fredericksburg and Annapolis, Md.
A Doorway of a Commercial Building in Boston.
Mantels in a Residence in Baltimore.
A Doorway in a Residence in Baltimore.
Details from a House in Dorchester, Mass.
Architectural Iron-Work in Philadelphia.
In addition to the above full-page illustrations there is in each issue at least one Vignette of Buildings of Moderate Cost, selected for architectural merit within a modest limit of expenditure.

Reading matter of special architectural value is—

The discussion by architects of the requirements of preparatory education desirable to fit students of architecture for their profession.
Discussions of the terms of competitions for plans of the Boston Public Library, the Cincinnati City Hall, and other notable buildings.
Cottage Hospital Construction and Management, By Mr. Henry C. Burdett, of London, author of Cottage Hospitals, etc.
Critique of the Exhibition of Architectural Drawings at the Salmagundi Exhibition.
Terms of the competition for plans of the Kansas City, Mo., Building Exchange; a valuable reprint.
There is also much information for architects in the articles on the engineering of building construction and on heating and ventilation, some of which are noticed below.

Engineering—

Among the specially prepared articles, fully illustrated, we notice these:

The series on Builders' and Contractors' Engineering and Plant, which are illustrated articles in detail, of the construction of the Equitable Building and St. Patrick's Cathedral in New York City; of the Raising of the old U. S. Court House in Boston; of the Dredging Scows and Machinery used on several Government Works; of the Hoisting and other Machinery used on the Elevated Railroad of Brooklyn; of the Machinery used in the construction of the Suburban Elevated Railroad, of New York.

Building Construction and Details, describing the practice in the eastern and western parts of the United States and of Europe; of interest both to the engineer and architect.

The Engineering at the Lawrenceville School. Including description in detail, with illustrations of the drainage, sewerage, water-supply, heating and ventilation and plumbing of the work.

Recent Water-Works Construction in the United States. A series of illustrated articles descriptive of works now building or just completed.

The New Croton Aqueduct for New York City is described as it progresses in articles of great value to the engineer.

There are many descriptions, discussions, and notes of interesting water-works undertakings in America and Europe. These are generally illustrated, and, with the reviews of reports of water-works officers, make up a valuable history of current undertakings.

Modern Sewer Construction and Sewage Disposal. A series of papers by Edward S. Philbrick, Mem. Am. Soc. C. E., on the modern theory and practice of sewer work.

Recent Sewer Construction contains a number of illustrated articles descriptive of the most important sewer work, such as that at Newark, N. J., now in progress.

Pavements and Street Railroads is a series of papers on the construction and maintenance of roadways.

In the Natural-Gas Supply of Pittsburg and Vicinity is given a very fully illustrated account of the mechanical means used in applying natural-gas to manufacturing and domestic purposes.

In addition to the serials, there are many articles on General Engineering, Water-Works, Sewerage, Pavements, and other topics of interest to Engineers, Contractors, and Builders.

Domestic Engineering—

This department relates more particularly to topics connected with the welfare of the individual. Under it there are, in this volume, descriptions of the heating by steam and hot water of notable buildings in the United States and Canada, such as the building for the State, War, and Navy Departments at Washington, the High School at Honesdale, Pa., the Post-Office at Woodstock, N. B., and others.

Descriptions of plumbing.
A series of articles on the theory and practice of Hot-Water Heating, by "Thermus."

A discussion of the practicability of heating railway cars by means which will not incur the risk of burning passengers in case of collision, with descriptions of several new systems.

Editorials and notes on the preservation of health, by purity of water-supply, proper sewerage, and similar means.

Reviews of reports of boards of health, and books on sanitary topics.

Contracting Intelligence—

This department is a very complete record, week by week, of projected works in water-supply, sewerage, gas, railroad construction, etc., of great value to the engineer, contractor, builder, and merchant. Returns of projected buildings are also made by special correspondents from all parts of the United States for each issue.

The Proposals give the earliest information of projected works from the Governmental departments, municipal bureaus, and private undertakings.

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THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.
NUMBER 1.

PUBLISHED EVERY SATURDAY.

NEW YORK, JUNE 4, 1887.

LONDON, JUNE 18, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

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OFFICE IN GREAT BRITAIN,
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TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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THEATRE FIRES.

THE destruction by fire of the Theatre Comique, Paris, and the attendant loss of life make timely the publication of statistics of destruction of theatres by fire in 1886, which the *Gesundheits-Ingenieur* quotes from the *Deutsche Bauzeitung*. "The Fire Commissioner, G. Gilardone, in Hagenau, writes, that the theatre fires of the past year are again less numerous than in the preceding year, since they amount to only six, if one case occurring in the last days of the year 1885 is included, as is necessary for comparison with corresponding records.

1. On December 7, 1885, the auditorium of the German Theatre at Moscow burned down; stage, boxes, and some rooms besides were preserved.

2. January 2, 1886. Complete destruction of White's Theatre in Detroit, Michigan.

3. March 12, 1886. Burning of the city theatre (Stadttheater) in Lemberg, which, however, was confined to the stage.

4. May, 5, 1886. Complete destruction of the Theatre in Derby, England, after the same had been opened only about six weeks.

5. July 29, 1886. Complete destruction of the theatre in Tinnervally, British India—probably only a very light wooden building.

6. Complete destruction of the "Teatro dei Filodrammatici" in Ravenna, originating in a private lodging located in the building. Here also the structure was a light one. The day and hour of the accident are not precisely stated. Two more cases—one in Spain, one in Algiers, only indefinitely reported—are apparently of such unimportance that they may remain out of consideration. Interest is attached to accidents Nos. 1 and 4, since they give evidence of the very remarkable danger under which new theatres stand.

The accident No. 3 is interesting, since they succeeded in confining to its place of beginning a fire originating in a very dangerous locality.

Gilardone's statistics show finally the interesting fact of the continual decrease in the number of theatre fires since the year of the Vienna Ringtheater fire. Since then the following have occurred: 1882, 25 theatre fires; 1883, 22; 1884, 10; 1885, 8; 1886, 6.

It is unimportant if these figures be quite exact or not; they give, nevertheless, a striking proof of the significant influence exercised by the special protective measures universally adopted since 1881."

Engineering, in a recent editorial, thus refers to the American Exhibition now open in London:

The grounds are more extensive and should be more beautiful than at South Kensington, and though the switch-back railroad and the toboggan-slide suggest a more demonstrative spirit of amusement than would suit the tone of many of the patrons of the Fisheries and its successors, they will probably draw many thousands who will like the place all the better for these entertainments. But there is no doubt that exhibition, grounds, switch-back railroad, toboggan-slide, and all the other attractions are but side-shows to the great Wild-West entertainment. By no possible stretch of ingenuity can this feature be brought within the scope of criticism in *Engineering*. None the less, however, did a crowd of prominent members of the profession, to say nothing of those eminent in almost every other path of art, science, and industry, en-

thusiastically follow the prolonged performance that for the first time was given to a British audience on Monday last. The grand stand which dominates the arena is large enough to hold nearly 20,000 persons, and of itself is a wonderful spectacle when crowded on every tier and from end to end of its vast sweep.

We believe that the exhibition is practically an American enterprise—we mean that most of the heavy capital required has been furnished from the United States—and we trust that those most deeply interested in the welfare of the undertaking will not be wanting in firm and judicious management—a condition as important as an attractive show. There is little doubt, we think, that if the exhibition is a success, it will tend largely to increase pleasant and familiar relations between this country and America, while if it should not succeed an opposite result will unfortunately be effected. The public are certainly ready to do their part to bring about the former and much-to-be-wished-for conclusion. It depends, therefore, almost wholly upon the executive.

We have no exact knowledge on the subject, yet we venture to state our belief that the only American capital invested is that in Buffalo Bill's Wild-West Show enterprise. What connection that has with the American Exhibition corporation of course we do not know. While we, like our English contemporary, wish success to the exhibition, we cannot, like it, entertain the feeling that its failure would in any way interfere with "pleasant and familiar relations between England and America." We do not believe the failure or success of that particular exhibition would have the slightest effect on the feelings Americans have toward England and Englishmen, since on this side of the water this exhibition is not regarded as an American enterprise.

STANDARD PIPE-THREADS.

In noticing the adoption of a standard thread for wrought-iron pipe and fittings by manufacturers in the United States, *Engineering* compliments the American Society of Mechanical Engineers, through whose agency this important movement was successfully accomplished. It asks, "When will any of our engineering societies do the like for us?" and suggests that an attempt be made, and "if a standard were put forth by a committee of the two leading engineering institutions and the Board of Trade, and were so framed that it did not hurt the susceptibilities of any leading firm, there seems no reason, other than British obstinacy, why it should not be adopted."

In our opinion, if this obstinacy prevails and British manufacturers refuse to adopt a standard thread, that circumstance will help the export trade of the United States in pipe and fittings, since purchasers in other countries will prefer to be spared the annoyances inseparable from mixed threads, and, consequently, prefer American goods.

CINCINNATI seems to be a locality where an architect's services are not highly valued by building committees. We recently had occasion to criticise the building commissioners of the new City Hall for their method of instituting a competition, and now we notice that trustees for the erection of a \$100,000 armory advertise for plans for a building to accommodate twelve companies of infantry and a battery of artillery, in which they simply ask for "plans, drawings, and specifications." They offer absolutely nothing to

those whom they invite to send in plans, and they allow only four weeks' time for the preparation of what they appear to want. Our recent remarks about the City Hall competition would seem to apply equally well to the men in charge of this one, though the wording of their advertisement would seem to indicate that they are even more ignorant than the members of the other committee.

RESULT OF CINCINNATI ARCHITECTURAL COMPETITIONS.

A GENTLEMAN in Cincinnati writes us:

"The result of such architectural competitions in this city as you have so severely criticised may be illustrated by the following editorial in a recent number of the *Times-Star*:

"The plans for additional buildings for the Centennial Exposition are now being exhibited at the Chamber of Commerce, and to say that they are disappointing is putting it mildly. The majority of them are absolutely destitute of new ideas. One architect has imitated a series of circustents in his design for a main building with admirable suc-

usual exhibition rule, the majority of the exhibits were conspicuous by their absence. It was unfortunate, also, that, owing to an accident to the steam-main on the morning previous, the machinery in the Motion Department could not be started, and still further unfortunate that the electric-light installation was not complete, and that the building was, therefore, in darkness during the evening, although the electric lamps in the grounds were lighted about 9 o'clock. The result of these drawbacks was to throw the "Buffalo Bill Wild-West Show" into greater prominence, as this department was absolutely ready and complete, making the exhibition really second and a side show to Buffalo Bill, which, to say the least, is to be regretted. When the exhibits are in place they bid fair to be of interest.

Certain experiments of a new method of ventilation, known as the "D. C. Green Ventilating System," have just been held at 91 Queen Victoria Street, London. The principle is, the discharge of compressed air, depending upon the induced current for efficiency. A compressor supplies the air at a pressure of three to five pounds to the

and eight torpedo tubes. Her heaviest shot would be 1,800 pounds, and the total weight of the broadside 4,760 pounds.

Dr. W. Collingridge, the Medical Officer of Health, Port of London, states in his report for the latter half of the year 1886, to the Port Sanitary Committee, that during the six months 11,064 vessels of all classes were inspected by the officers of the authority, of which 798 were found to require cleansing in some form or other, being a proportion of 7.2 per cent.

SAFETY-VALVE.

OUR SPECIAL ILLUSTRATION.

WASTE-WEIR OUTLET OF THE KANGRA TANK,
AHMEDABAD, INDIA.

THE subject of our special illustration is the outlet of a waste-weir or overflow sluice of one of the large tanks or reservoirs at Ahmedabad, India. Our drawing is made from a photograph procured in London. Fergusson, in his history of *Indian Architecture*, says: "Among the objects of architectural beauty are the inflow and outflow sluices of the great tanks which abound everywhere around the city. Nowhere did the inhabitants of Ahmedabad show



RESIDENCE OF I. W. BIRDSEYE, BRIDGEPORT, CONN.—J. W. NORTHROP, ARCHITECT.

cess; but, after all, that was not what was wanted. The other architects appear to have made a hash of the modern skating-rink, the Centennial Buildings at Philadelphia, with here and there a dome or a bit from the London Crystal Palace thrown in. Then, half of the plans are merely for effect on paper, being utterly impractical when it comes to putting them in wood and iron.

"This same paper also has called attention to the superior methods of Norcross Brothers, of Boston, in erecting the new Chamber of Commerce. They built a board fence and walk around the lot and erected derricks inside. It is the custom here for builders to use the streets, making pedestrians take to the mud."

OUR BRITISH CORRESPONDENCE.

The American Exhibition Opening—The Green Ventilating System—War-Ship "Victoria"—Inspection of Vessels by London Port Authorities.

LONDON, May 18, 1887.

THE American Exhibition at Brompton was duly opened on Monday, 7th inst., by Colonel Russell. Following the

square inch, through pipes terminating in a special nozzle, discharging thence into a larger tube or shaft acting as a conduit, said tube or shaft being supplied with fresh air independent of that from the special nozzle. The apparatus can be utilized for either extraction or supply. The pipes leading to nozzles are merely ordinary gas-pipes, 1-inch to 1 1/4-inch, and so can readily be led to any required situation in the building. The prominent objection to the system is the noise due to the discharge of the compressed air, but this is held to be of very little consequence in a large building.

Probably the most powerful war ship afloat is the "Victoria," just launched from the yard of Messrs. Armstrong, Mitchell & Co. Her length is 340 feet, breadth 70 feet, mean draught 26 feet 9 inches, and displacement 10,500 tons. Her engines are 12,000 horse-power, and she will steam 17 knots. Her armament is, two guns of 110 tons each, firing ahead, one 30-ton astern, and armored side-batteries of twelve 5-ton guns and twelve 6-pounders, and nine 3-pounders, the latter quick-firing guns. In addition to this, she has a complement of machine guns, rams,

how essentially they were an architectural people as in these utilitarian works. It was a necessity of their nature that every object should be made ornamental, and their success was as great in these as in their mosques or palaces."

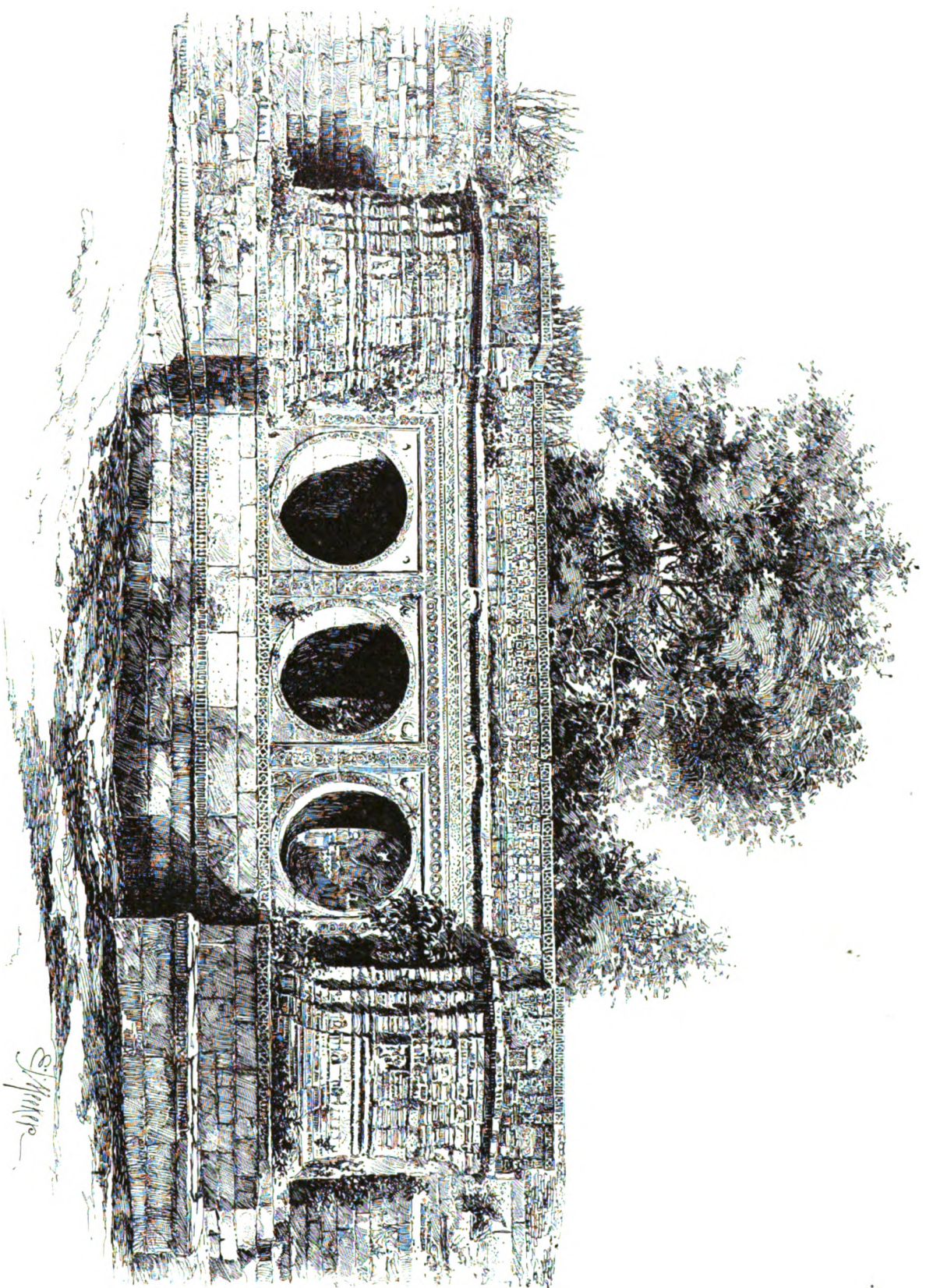
OUR VIGNETTE ILLUSTRATION.

RESIDENCE IN THE SUBURBS OF BRIDGEPORT, CONN.—
JOSEPH W. NORTHROP, ARCHITECT.

THE subject of our vignette illustration this week is the residence of Mr. Isaac W. Birdseye, in the suburbs of Bridgeport, Conn. The first story is of Philadelphia brick, trimmed with light granite. The exterior of the second story is frame, shingled, gables rough cast, and the roof is slated. The interior finishings are in the natural wood, parlor and library in cherry, hall and dining-room in oak. The floors of the vestibule, halls, and conservatory are tiled. The hall and dining-room have paneled wainscots and paneled ceilings. There is plate-glass in windows and stained glass in the dining-room. Mr. Joseph W. Northrop, of Bridgeport, was the architect.

OUR SHEET OF DETAILS.

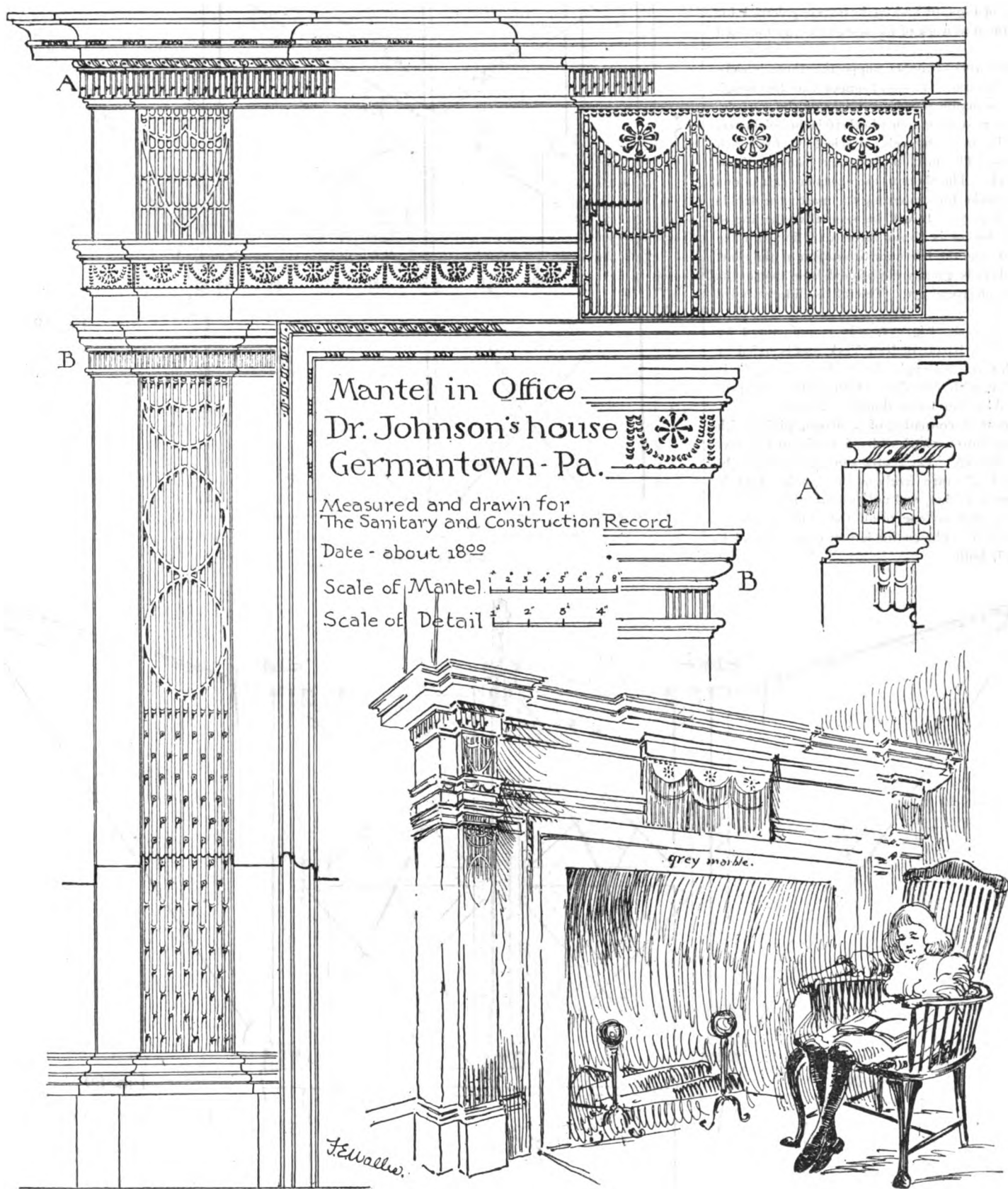
OUR detail sheet, the eleventh in the series, shows a mantel in the house of Dr. Johnson, at Germantown, Pa. The house was built in 1798.

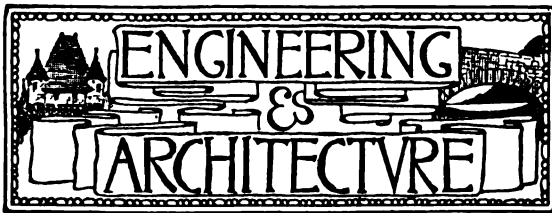


THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

WASTE WEIR OUTLET OF KANGRA TANK,

AHMEDABAD, INDIA.





BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XVIII.

(Continued from page 572, Vol. XV.)

We illustrate in Figs. 68 and 69 the traveling derrick for the erection of the iron-work of the Kings County Elevated Railway.

This is a frame-work of timber, supporting three derricks and a working platform. The lower supports are far enough apart to span the double street-car tracks on the surface. The whole structure rests on four wheels 16 inches diameter, which travel in iron channels attached to 6x12-inch wooden sleepers. The machine constantly *retreats* from the finished work. The shoes to the masts are cast in one piece with the cheeks for supporting the mast; the details are shown in Fig. 70. It will be seen that the line of thrust from the booms is almost directly in line with the point of support, and the tendency to rotation of the short supporting timbers is greatly diminished from that in the derricks shown on page 571. The fall is differently led also.

The hoisting-engine, Fig. 71, was manufactured by Messrs. Copeland & Bacon, of New York, and is styled by them a "4-inch reversible engine for bridge-building." It is a trunk-engine, with cylinders $8\frac{1}{2} \times 9$ inches, and provided with a link-motion for working the valves.

The gear is central, consisting of a driving-pinion with 11 teeth, gearing into a wheel with 38 teeth on the first shaft, and that into 56. The shafts run entirely through, and the capstan-heads turn freely on them, being held in place by the cap or washer, and nut as seen. The clutches work on feathers, and any one or all the winches may be engaged as desired. The engine is very compact, and is well and strongly built.

The work of putting in the foundation is progressing rapidly, and the erection of the superstructure is now under way.

This machine is manifestly less easily handled than one which travels directly upon the finished work; but

the design of the superstructure, if we are rightly informed, does not admit of this method.

The iron-work is under contract with the Phoenix Bridge and Iron Company. The chief and locating engineer is Mr. C. E. Cook and the foreman of erection, Mr. W. D. McKee.

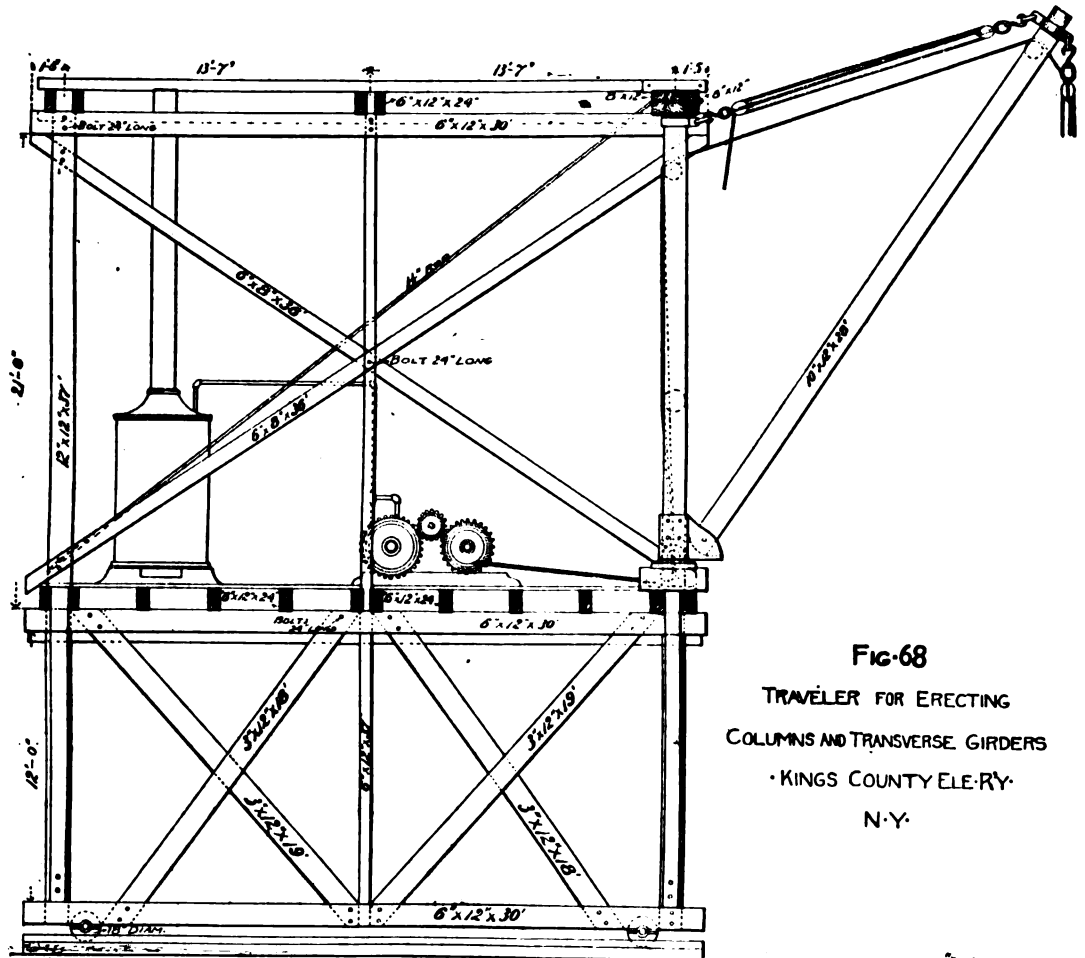


Fig-68
TRAVELER FOR ERECTING
COLUMNS AND TRANSVERSE GIRDERS
KINGS COUNTY ELEV. RY.
N.Y.

"THE SANITARY ENGINEER
&
CONSTRUCTION RECORD"

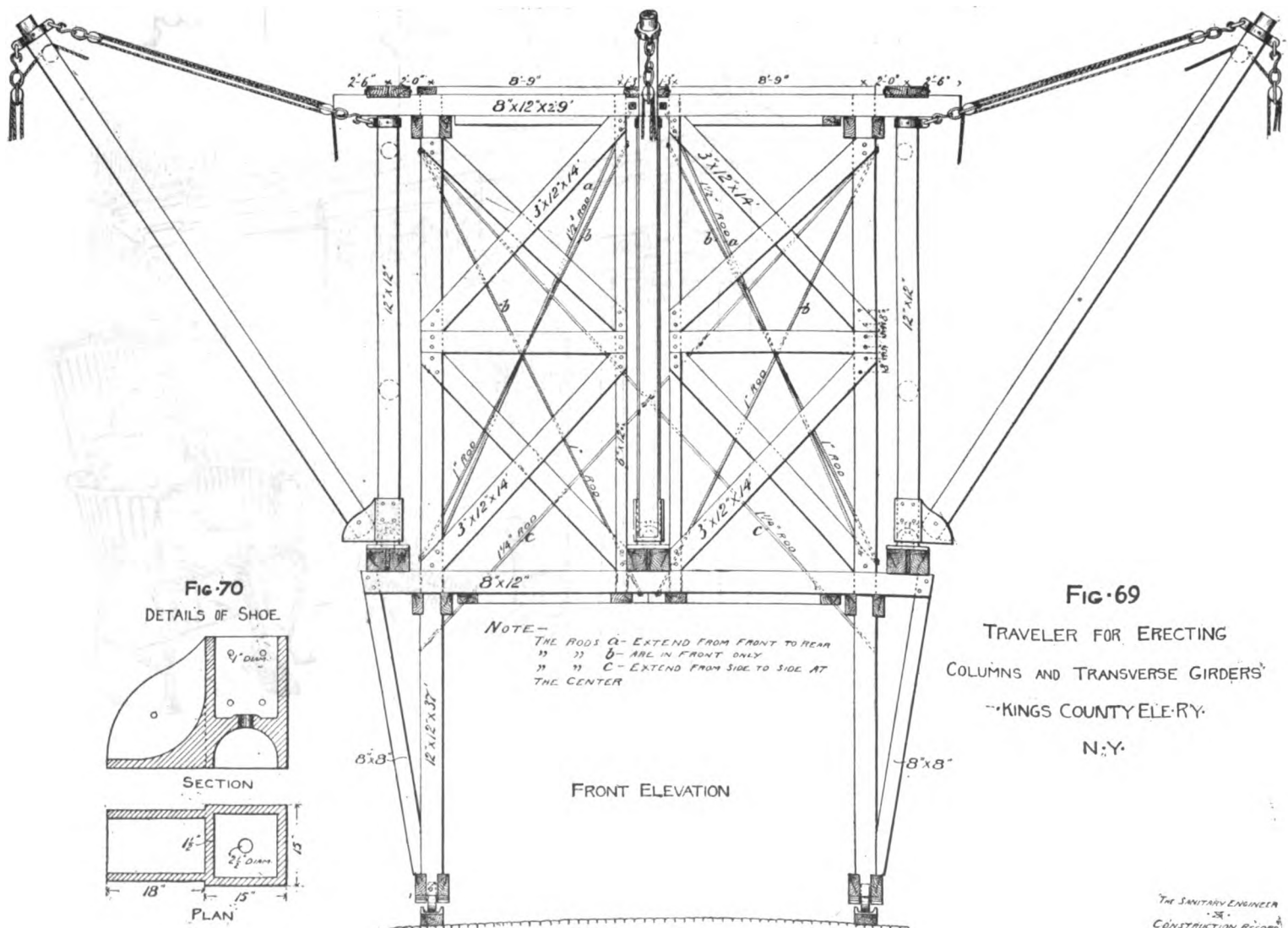
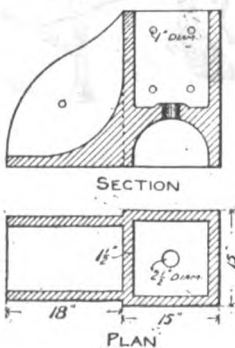


Fig-69
TRAVELER FOR ERECTING
COLUMNS AND TRANSVERSE GIRDERS
KINGS COUNTY ELEV. RY.
N.Y.

"THE SANITARY ENGINEER
&
CONSTRUCTION RECORD"

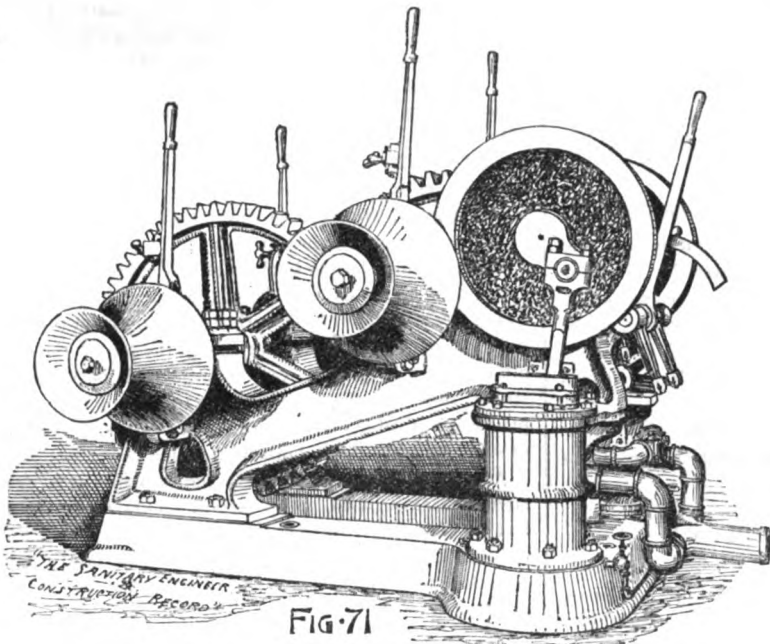
Fig-70
DETAILS OF SHOE.



NOTE—
THE RODS A—EXTEND FROM FRONT TO REAR
" " B—ARE IN FRONT ONLY
" " C—EXTEND FROM SIDE TO SIDE AT
THE CENTER

THE SWEETWATER DAM AND IRRIGATION EXPERIENCE IN SOUTHERN CALIFORNIA.

We are indebted to Mr. James D. Schuyler, Chief Engineer of the Sweetwater Dam, now in process of construction at San Diego, Cal., for the following particulars regarding it:



•HOISTING MACHINE•USED IN ERECTING•KINGS COUNTY•ELE•RY•
N.Y.

The dam in process of construction by the San Diego Land and Town Company is designed for the purpose of storing the winter flow of the Sweetwater River for use during the spring, summer, and fall for the irrigation of the wide belt of fertile Mesa lands adjoining San Diego on the south and extending for some eight miles along the shores of San Diego Bay, as well as for the domestic supply of the rapidly growing town of National City. The Sweetwater River has a water-shed of about 200 square miles, of which about 180 square miles lie above the point where the dam is located, some seven miles above its mouth. It heads in the Cuyamaca Mountains to the east, near the rim of the Great Colorado Desert, at an altitude of 5,000 to 6,000 feet, and is some fifty miles in length. Its watershed is, therefore, quite narrow, and generally precipitous in its upper course. The rainfall along the coast ranges from one to twenty-five inches annually, but is generally less than eight inches. In the mountains it is often as high as fifty inches, besides a snowfall of several feet. The snow melts rapidly and does not prolong the flow of the stream into the summer months as is the case in the Sierra Nevada of Northern California. Consequently the stream is subject to sudden floods after each rainstorm, which expend their force in a few weeks, and the flow of the stream dwindles in summer to less than one cubic foot per second. As a source of irrigation supply it was, therefore, unreliable without establishing means for storing the winter flow. The site selected for the dam is an admirable one. A low range of hills formed by some eruptive dike here crosses the course of the stream, and the narrow cañon worn through them, less than half a mile in length, affords the opportunity for converting the large valley above the cañon into a great artificial lake. It was one of the rare places formed by nature with every suggestion to man to avail himself of the opportunity. The best of materials were at hand, and we were given a choice, as there are unlimited beds of the finest clay immediately above the dam, and a cliff 150 feet high of the choicest rock ever made for dam purposes but 600 feet below. An earthen dam was at first contemplated, but owing to the narrowness of the cañon (only 280 feet at a height of 60 feet) a masonry structure was decided upon as the cheaper and more stable. Work was begun December 1, 1886, and the dam has now reached a height of sixty feet over a considerable part of its length, and will be completed to that height by June 1, 1887. When finished to that height we shall begin at the base with a new backing, with the view of carrying the structure to a height of ninety feet. The cross-section of the 60-foot dam is shown below in sketch. I have not yet fully decided upon the lines for the higher structures, but they will be nearly as shown by the dotted lines.

The dam is built on a true curve of 222.3 feet radius, and at its ultimate height of 90 feet will have a spring

(middle ordinate) of 35 feet and an extreme length of 360 feet. Its length at the level of the outlet-pipe is 140 feet. at the height of 40 feet it is 230 feet long; at 60 feet height 280 feet long, while it carries its maximum height for only the distance of 40 feet.

The bottom was exceedingly irregular and rough, like a succession of cones of all sizes and shapes.

The excavation for the foundation was comparatively easy in the creek channel, as the water had polished the bed-rock and it was only necessary to dig out the crevices. At the sides all the loose and soft rock was stripped away and the wall well bonded into the solid ledge. The masonry is of the best character, of rough rubble, laid in blocks as large as can be handled with derricks, in mortar made of one part of Portland cement to two of sand for the four feet next the face, and one of cement to three of sand in the body of the wall. It is mixed as thin as can be handled conveniently without flowing out of the joints and thoroughly tamped. Since the dry weather has set in I keep a man at night throwing water over the masonry in order that the mortar shall not dry out before it has thoroughly set. The stone is a metamorphosed siliceous rock,

containing hornblende, iron pyrites and magnetic iron in large proportion. The weight is, therefore, greater than granite. Various tests made show its specific gravity to be 2.8 to 3.2, or 175 to 200 pounds per cubic foot. This unusual weight brings up the average weight of the masonry to over 160 pounds per cubic foot, and accounts to some extent for the rather slender dimensions that have been adopted. The wall is theoretically stable without reliance upon its arched form, and the transmission of its strains to its abutments.

The reservoir formed by the wall covers 275 acres at the 60-foot height, and has a capacity of 1,250 million gallons, of which 91 per cent. is carried in the upper 20 feet of height. At its ultimate height of 90 feet it will contain 6,000 million gallons, and cover 700 acres. The latter volume is sufficient to irrigate 20,000 acres of land and supply a city of 10,000 inhabitants, if it were filled but once in two years. In other words, the reservoir provides for the contingency of a rainless year by carrying two years' supply. The class of irrigation to be carried out will be of the highest and most costly type, which has formed its fullest development in Southern California. The water will be conveyed under pressure in pipes to each tract of land, and will be sold in volume as used. It is designed that each irrigator shall have a small concrete or cement-lined reservoir on the highest point of his land, and will have it filled periodically from the mains, paying for it by the reservoirful.

Experience has demonstrated that the Mesa lands of San Diego County require a less volume of water in irrigation than any other soils of the State, but the little they do need they need very badly. The average volume required on large areas, and on all classes of cultivations, is estimated at one miner's inch of continuous flow for each 30 acres. A miner's inch will flow 1,728 cubic feet in twenty-four hours, hence the quantity allowed for as sufficient will cover the whole surface about 6 inches deep in one year, or be equivalent to a rainfall of 6 inches. A much greater quantity than this is found to be not only un-

necessary, but positively deleterious, affecting the quality and flavor of the fruit. An exception to this rule is the orange, which demands water incessantly in small, but constant, supply. In California generally more injury is done by excessive irrigation than by the lack of it, and the most perfect and satisfactory results have been obtained in the southern part of the State, where the scarcity of water has compelled the utmost economy in its use.

Cost.—The cost of the dam at the elevation of 60 feet will be \$90,000, and when carried to completion, \$160,000. The distributing system and mains will cost about \$500,000. The average cost per acre will not be far from \$50. The lands thus supplied sell readily in small tracts for \$300 to \$500 per acre.

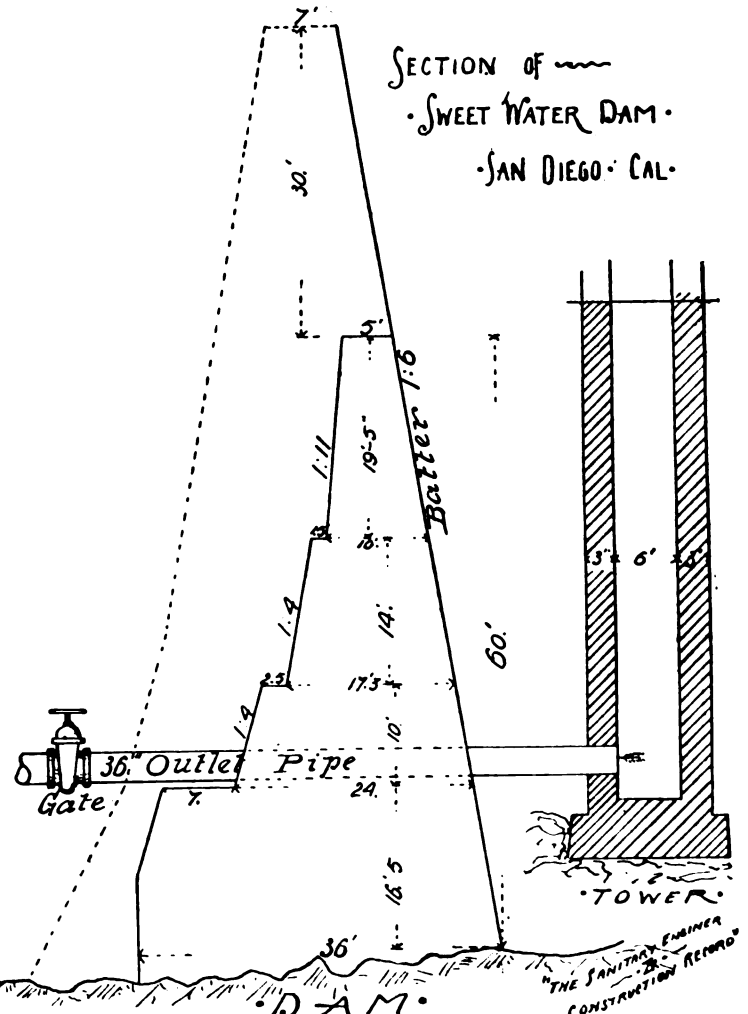
The cost per cubic yard of masonry in the wall ranges from \$9 to \$12. I take at random from my memorandum-book the average of a week's work per cubic yard of masonry laid as follows:

Quarrying rock.....	\$0.34.7 per cubic yard.
Handling and loading rock.....	0.34.6 " "
Hauling.....	0.62.5 " "
Sand.....	0.36.0 " "
Cement.....	4.46.0 " "
Masons.....	0.84.0 " "
Hod-carriers.....	0.27.2 " "
Mortar-mixers.....	0.16.7 " "
Derrick-work.....	0.41.9 " "
Foremen.....	0.28.8 " "
General labor.....	0.47.0 " "
Blacksmithing.....	0.06.8 " "
Total.....	\$8.66.2

Masons are paid \$5 per day; hod-carriers, \$2.50; common labor, \$2 to \$2.25; foremen, \$6.

The stone is loaded with a simple shear by derrick at the quarry upon wagons, and hoisted upon the wall with horse-power derricks. The heaviest stones, two tons and over, are hoisted at the rate of 60 feet per minute, clear lift.

The disposal of the waste-water and the method of controlling the admission of the water to the pipes is thus dealt with. The latter is performed by means of a hexagonal tower of stone masonry, in which are set at intervals of 10 feet elevation cast-iron elbows, with bell-mouths, outside the tower. A simple cast-iron valve sets on each bell-mouth, with a wire-rope attached running over a sheave in the house on top, with a counter-weight passing down inside the tower. The valve is hoisted and replaced with a basket-screen when water is to be admitted to the tower. The great number of inlets into the tower afforded by this method allows of drawing water from any level de-



sired. When the gate in the pipe below the dam is closed all pressure is relieved from the valves so that they are easily hoisted.

The waste-water is to be utilized to furnish power to pump a portion of itself to an auxiliary reservoir 150 feet higher than the main reservoir. A fall of 100 feet can be obtained, and Pelton hurdy-gurdy wheels will be used to convert the power into useful work. The water used for irrigation on the lowest levels will also be used to supply power through the same wheels, to keep up the pumping during the summer.

The main wasteway for flood-waters will be through a gap in the side of the reservoir 2,000 feet above the dam. This gap will be just reached by the 90-foot contour.

The main pipe will be 30 inches diameter, 5 miles long, and the distributing-pipes, to be laid this year, will have an aggregate length of about 40 miles.

RAPID RAILWAY BUILDING.

The Manitoba Company Pushing Westward at the Rate of Five Miles a Day—Six Thousand Six Hundred Men and 3,000 Teams at Work—How They Are Fed.

WHITE EARTH RIVER, MOUNTRAILLE COUNTY, DAK.

A CORRESPONDENT of the St. Paul *Pioneer Press* thus describes some rapid railway construction:

"Just beyond this point and eighty miles west of Minot, the traveler finds himself at what railroad men call 'the front,' or the end of the track of the extension which the Manitoba Railway Company is now making to Great Falls, Mont. To speak more accurately, this was the end of the track yesterday, but to-night that point will be five miles further westward, and by to-morrow yet five miles further. From Minot here the work has been in progress since the first week in April. From now on it is proposed to complete five miles of track each day, thus achieving the greatest feat ever attempted in the way of rapid railway construction. From here to Fort Buford the distance is a little over sixty miles, and it is the intention to have the road open to that point by June 1. Thence to Great Falls the distance is 403 miles, and trains will in all probability be running to that point before the middle of September.

"It can readily be surmised that the accomplishment of this gigantic enterprise requires little less than an army of workers, and that is what one finds here. The number of men now at work is 6,600, and the number of teams, 3,000. With this force it is hardly to be wondered that the dirt is flying at a lively rate. From here to seventy miles beyond Fort Buford there is one unbroken series of graders' camps. Fifty of these camps can be seen from one point some distance beyond White Earth. By June 1, between 3,000,000 and 4,000,000 cubic yards of earth will have been taken out, and by the time Great Falls is reached the amount will aggregate not far from 10,000,000. On the Canadian Pacific, during the whole of last summer, the amount of earth handled was only 6,700,000 cubic yards, and this was considered a remarkable piece of work. A few figures may serve to give a clearer conception of what is involved in the construction of five miles of railway track in one day. A rail is 30 feet long, and there are consequently 352 to the mile, or 1,760 to every five miles. As each rail weighs 600 pounds, the amount of steel handled in one day aggregates 1,056,000 pounds. It takes 2,640 ties to the mile, or 13,200 per day. Thirty-six 200-pound kegs of spikes are used to the mile. There are 32 'spikers' to every five miles of track, each man of whom drives 840 spikes a day, which, at the average of three blows to the spike, gives 2,520 blows per man per day. A mile of rails takes 1,408 bolts, which are handled by fourteen 'bolters,' or 503 each per day. To avoid delays in the progress of construction by reason of rough country, it is the intention of the contractors to work five gangs of men in five-hour reliefs during a portion of the time. Work will begin at 3 o'clock in the morning, and the darkness will be scattered by thousands of torches.

"With such an army of men and teams at work far from the centres of civilization, and in a totally unproductive country, it can be readily seen that the task of securing and distributing supplies is one of enormous magnitude. Indeed, there is little doubt that greater executive ability is required in this than in almost any other department of railway construction in the far West. Here at White Earth is, for the present, the headquarters of the supply train, consisting to-day of twenty cars filled with every conceivable thing necessary for man and beast. There is grain, flour, canned goods of all sorts, butter, hams, sugar, wagons, harness, plows, boots and shoes, pipes and tobacco—in fact, nothing is lacking. Every day sees a big hole made in the stock, and every day sees the hole replenished by incoming trains. Day before yesterday 15,000 bushels of oats were sent out by wagon and yesterday 5,000 bushels, all for distribution along the line for a distance of forty miles. From here on the trail along the line is marked by one continuous stream of freighters' teams distributing supplies to the various camps. The other day a herd of 170 head of cattle was driven in and it seemed that there at least was enough meat for some time to come. A rapid calculation, however, showed that it would furnish only

about ten pounds to the man. Already 250,000 pounds of flour and 500,000 bushels of oats have been purchased. Lovers of baked beans will learn with alarm that the supply of that luxury is about exhausted. A letter just received from one of the largest wholesale firms of St. Paul states that if the demand is to continue throughout the summer as large as it now is, it will be necessary to import from Europe. They say they have now secured all the beans that can be found in the United States, and that they have only enough to last this army here for two months.

"Another interesting feature of this train is the hospital cars, where the laborers suffering from disease or accident are cared for by a regular physician, assisted by several nurses, the expenses being met by a contribution of two cents a day from each laborer employed."

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE New England Water-Works Association will hold its sixth annual convention at Manchester, N. H., June 15, 16, and 17, 1887. The headquarters of the association will be at the Hotel Windsor. Those intending to be present are requested to communicate with Mr. Charles K. Walker, Superintendent, Manchester, N. H., in regard to hotel accommodations.

Hotel rates will be \$4, including the dinner of Wednesday, and the breakfast on Friday morning. Rates for a single day, \$2.

THE LOUISIANA ASSOCIATION OF ARCHITECTS.

AN Association of Architects of the State of Louisiana has recently been formed at New Orleans. Thomas Sully is President; William Fitzner, Vice-President; W. C. Williams, Secretary and Treasurer; and Messrs. S. M. Patton, A. Toledano, B. M. Harrod, J. A. Braun, and C. A. Leffingwell are the charter members. Mr. Sully, who was a member of a Committee of the Western Association of Architects whose duty it was to promote the formation of State associations, has been active in bringing about the formation of this society.

REGARDING THE STUDY OF ARCHITECTURE.

MR. GEORGE SNELL, of Boston, in reply to Professor Osborne's query on page 604, issue of May 7, writes:

"In answer to the questions of Professor C. Francis Osborne, I would say, algebraic trigonometry and conic sections will be of little or no use to the architect; he should know enough of the algebraic mode of calculation to be able to solve simple equations and to use symbolic formulas instead of rules. If, however, he aspires to design any original construction, he should advance in the direction of the binomial theorem and the differential and integral calculus sufficiently to understand the calculations which determine the comparative strength of the various shapes of girders and other portions of a construction."

Mr. Leopold Eidlitz, of New York, writes:

"In answer to Professor Osborne's inquiry (THE SANITARY ENGINEER AND CONSTRUCTION RECORD, May 7), whether a thorough training in (1) geometry and conic sections, (2) algebra, and (3) trigonometry give the architectural student all the purely mathematical knowledge that is necessary, I should say that the architect who intends to master modern iron construction and the theory of arches should be able to read text-books like Weisbach, Rankin, and Culmann (Die Graphische Statik. Zurich: Mayer & Zeller. 1875), with ease. To do this requires a knowledge of analytical geometry and the calculus."

W. W. Goodrich, architect, of Oakland, Cal., Instructor of Architecture at Oakland Institute, writes:

"Professor Osborne's questions, May 7, 1887, page 604 of your excellent journal, are very timely. I insist in my classes, as per my curriculum as per enclosed catalogue, which see—geometry, algebra, and trigonometry." He also thinks "an architect should also serve at least two years as a carpenter and stair-builder. This will give him a practical insight of the construction—not in a city shop, but a country shop, of say a place of several thousand people. There he will get all of the various ideas that go into the construction of a frame or brick building, etc."

RAILROAD BALLAST AND ITS MECHANICAL EXTRACTION.

IN a recent article in *Le Genie Civil* Mr. Jules Michel, Chief Engineer P. L. M. R.R. of France, is quoted as saying his engineers have found in the last fifteen years that when the ballast on the road has lost its permeable quality it must be worked over and brought back to that condition. In opening up pits along the railroad they found so much

sand with the ballast that the cost of screening would more than pay for extra harsh and mechanical screening at some central pit. At first excavators were used and the materials screened. This process was slow and not satisfactory.

In 1885 Messrs. Martin Bros. & James added a pump to the excavator and delivered the material over a horizontal screen where a heavy stream of water carried the fine material back into the pit; a second screen separated the $\frac{1}{4}$ -inch ballast from the larger stones. The cost delivered was about 58 cents per cubic yard.

Lately Messrs. Delamare & Panty having a contract to furnish the P. L. M. R.R. with eighty thousand cubic meters of ballast, they set up a special plant at their pit. It consisted of a Universal Excavator, with a 25-horse-power engine, and also an elevator to raise the prepared ballast to a dump at a height of 23 feet.

The excavator has 16 buckets of $2\frac{1}{2}$ cubic feet capacity each; five are on endless chain, the drums being set in a frame to work from the side either above or below the road-bed. A pair of elliptical springs at the top of the chain allow a certain play in case a large rock or boulder is struck, thus allowing the buckets to pass over it. The platform is pivoted on the truck, so as to allow a revolution of some 60 degrees in a horizontal plane.

As the gravel is brought up by the excavator it is delivered into an inclined rotary screen. This screen is $3\frac{1}{2}$ feet in diameter, 7 feet long, and formed of $\frac{3}{8}$ -inch steel rods set $\frac{3}{4}$ of an inch apart. The inclination is adjustable according to the material. The speed of the screen is 30 revolutions per minute, and by means of a cam four hammers are raised and let fall, giving 50 blows per minute on top of the screen, thus preventing all clogging of the screening. The screen is geared from the engine. It can be removed in a short time and replaced by an ordinary chute for common excavating purposes or for loading the cleansed ballast into cars when needed. The screenings fall into open cars and are carried off to make the road-bed for the excavator.

The ballast falls into an iron box from which it is raised by the elevator which is on an adjoining track and run by a 7-horse-power engine. The track for cars of screenings is between those of the excavator and those of the elevator. The elevator has 27 buckets and can deliver to the height of 22 feet 21 buckets per minute. At this pit there was 35 per cent. screenings; in a day of 12 hours, 4 hours are spent in shifting cars, tracks, etc. Amount of ballast prepared and piled up per day 400 cubic yards, of which the cost was $10\frac{1}{2}$ cents, the cost by hand cleaning and excavation being 24 cents. The cost of the plant was \$26,500.

INTERNATIONAL EXPOSITION OF RAILWAY APPLIANCES AND INDUSTRIES, PARIS, 1887.

CHICAGO, ILL., May 23, 1887.

SIR: I am requested by the Executive Committee in France to ask the favor of appealing through your columns for the loan of any objects, books, medals, drawings, etc., relating to the history of railways and means of transportation generally, both ancient and modern, in this country.

I am directed also to say that all expenses of forwarding and returning the same to the lenders, packing and unpacking, will be defrayed by the Executive, and insured for the value the lender may put upon each object, and that special attendants will be told off for their safe custody.

All communications on the subject may be addressed to M. G. Senechal, 8 Faubourg Montmartre, Paris, or to Mr. George L. Fowler, M. E. (of New York City), Commissioner in charge for the United States, Palais de l'Exposition, Bois de Vincennes, Paris, France. By addressing communications direct to Paris, much valuable time will be saved.

Hoping you will kindly insert the above, and accept the thanks of the Executive Committee, I am

Yours truly, JOHN W. WESTON,
Commissioner-General for the United States.

NATIONAL CONVENTION OF WATER-WORKS SUPERINTENDENTS.

A MEETING of the City Council Committee on Water-Works, of Minneapolis, and the Special Committee recently appointed on the National Convention of Water-Works Superintendents, has been held, the joint committee uniting in a recommendation that the city should take full charge of the reception and the entertainment of the guests. The proposed programme was discussed fully. The convention will be held in that city July 13-15 inclusive.



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. V.

(Continued from page 633, Vol. XV.)

TO FIND THE FLOW OF WATER IN PIPES.

HOW TO calculate or find the rapidity of motion in the mass of water, or its velocity through the pipes of an apparatus, we will now consider. Let us take a tube, say twelve feet long, as shown in Fig. 12, and fill it with water at 40° Fah.—and what would ordinarily be called cold water—until it just reaches the 10-foot level at *a*; or, in other words, we have a column of water just ten feet high at mean temperature within the tube. If we now apply heat to the bottom of the tube and expand the water until it boils, or until the whole mass of water is warmed to 212° Fah., we will find that the column that was just ten feet

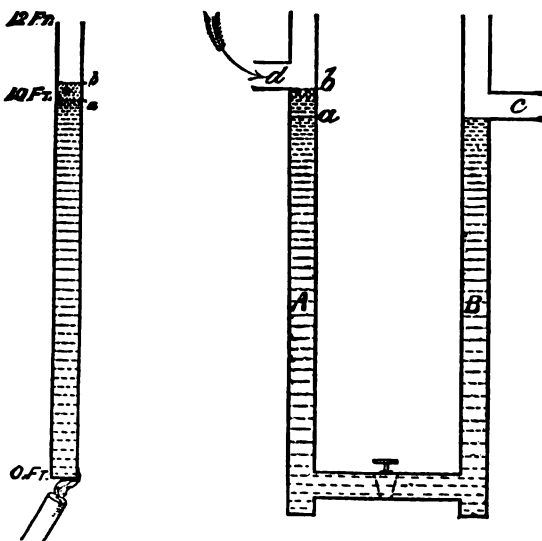


Fig. 12

Fig. 13

high when it had a temperature of 40° Fah. is now 10' 4 $\frac{1}{2}$ " high, or at *b* in the tube, having increased just .04 of its length (Dalton) by being warmed from 40° to 212° Fah.

If we now take two such tubes arranged side by side as in Fig. 13, and connect them at the bottom with a cross-tube and closed cock, arranging an overflow-pipe in B at the 10-foot level *c* and filling it (B) with water until it was on the point of flowing out, while at the same time we fill the pipe A with water to the 10' 4 $\frac{1}{2}$ " level (*b*), we will find on suddenly opening the cock the water will fall from *b* to *a*, overflowing at *c*, and that if we carefully measure its velocity at the start we will find it to be just 5.06 feet per second of time, or 303 feet per minute—exactly the velocity a piece of lead would obtain as it reached *a* if it fell from *b* to *a*, a distance of 4 $\frac{1}{2}$ inches:

If we now run water in at the pipe *d* (Fig. 13) so as to maintain a head of water in A equal to the height *a b*, the water will flow through the pipe A to the cross-pipe, through that pipe to B, and overflow at *c*, with a lineal velocity of a little over five feet per second, assuming the pipes are of equal diameter throughout, friction not considered. In other words, this will be the greatest theoretical velocity possible in the pipes of an apparatus for a ten-foot column, under the greatest ranges of temperature and density due to the pressure of one atmosphere.

Now, if our column is twenty (20) feet high the expansion of the water will be just double for the same range of temperature, and the fall will be 9 $\frac{1}{8}$ inches, but the velocity is not doubled by any means, and it will be found to be only 7 $\frac{1}{8}$ feet per second, as I will endeavor to show.

The fall of water in pipes follows the same law as the fall of a weight through a vacuum. Where a weight falls through the air it meets some resistance, and when water falls in a pipe it meets resistance by friction, etc., but we will not consider it here.

The simplest formula to express the law which governs the velocity of a body falling by terrestrial gravitation is

$$V = \sqrt{H} \times 8,$$

in which *H* = the height fallen from or the distance fallen through in feet, and *V* = the velocity in feet per second.

If we therefore apply this rule to a body falling 9 $\frac{1}{8}$ inches—in other words, .8 of a foot—we will find the velocity to be 7 $\frac{1}{8}$ feet per second, or 429 feet per minute, and the same is true of the water falling from the same height.

It will be noticed, therefore, that though the distance through which the water had to fall was doubled the velocity was not increased *one-half*, for the simple reason that the velocity increases only as to the square root of the height from which the water falls.

If we go on, therefore, and see what the velocity will be for a 100-foot column (which is ten times the height of the first column), the ranges of temperature remaining the same (40° to 212°) and the distance fallen from four feet, we will find by applying the rule it will be square root 4 = 2 × 8 = 16 feet per second, or 960 feet per minute, which is very little over three times the speed it would attain when falling from only one-tenth of the height.

The velocity last mentioned, however, will never be attained in the pipes of an ordinary heating-apparatus, as there cannot be in ordinary practice anything like 170° Fah. between the temperatures of the flow and return-pipes, even should there be a building 100 feet high warmed with hot water, and it is therefore simply instanced here to fix in the mind of the fitter that the increase of velocity of flow is small compared to the increase of height of the apparatus, and that comparatively shallow or low apparatus with an apparently small difference between the temperatures of the water in flow and return pipes will be found to have a velocity of flow surprisingly good, if the pipes are only sufficient in diameter not to retain its flow and properly placed and fitted.

(TO BE CONTINUED.)

DIRECT-INDIRECT VERSUS INDIRECT HEATING FOR LARGE BUILDING.

EARLHAM COLLEGE, RICHMOND, IND., May 14, 1887.

SIR: Will you please be kind enough to inform me on the following subject: Is not the "direct-indirect" system of heating much better for large college and public buildings than the "indirect," and will it not obtain as good if not better results in the way of ventilation? I mean the "direct-indirect" system as given by Baldwin on page 30 of his valuable book, "Steam-Heating."

My reason for asking is that the above college is now erecting two new college buildings, and the architect recommends the indirect system, with radiator coils in the cellar. The buildings will be entirely exposed, and often the thermometer is as low as 26° below zero. One building is 56' 4" x 35' 6" and two stories high; the other is in its extreme dimensions 174' 4" x 156' 4" and three stories high. If you would like to see plans I can send them to you in a week or so. Should not the warm-air registers in case of the "indirect" system and the radiators in case of the "direct-indirect" system be *always* placed immediately under the windows with the vent registers on the opposite side of the room at the floor?

An early answer will greatly oblige a subscriber and constant reader of your paper. EARLHAM.

P. S.—Our old plant is "direct" and we are going to do all of the heating from the one boiler-house and the same set of boilers.

[The system of warming and ventilating known as the "direct-indirect" system, in which the radiators are under the windows with the fresh air taken to them through air-passages under the sills leading to box-bases, should never be depended upon for ventilating school-rooms. Baldwin describes this system in his book as one of the usual methods of warming with which ventilation or the admission of air is combined; but he does not place it ahead of "indirect" heating as a means of ventilation, nor should it be so considered, all other things being equal for one moment.

With "direct-indirect" radiation enough air may pass through the inlets to supply air for two or three persons in a room, and, therefore, it may do for office-rooms or residences, provided it is properly done; but for schools or crowded academic rooms or auditoriums it is wholly inadequate.

Take, for instance, an inlet 4x12 (an average size for such work) or the third of a square foot, and assume it is passing air at five feet per second—an unusually high velocity for such work—6,000 cubic feet of air per hour is all that possibly pass through it; and even if you have the inlets to six rooms, 18,000 cubic feet, or sufficient

or twelve persons, is all that can pass. But in ordinary practice a velocity of five feet per second is not obtained, and the writer has known several of such apparatus that have worked the wrong way—i. e., passed the warm air out of doors instead of drawing cold fresh air in.

Again, such apparatus are supplied with dampers to keep the coils from freezing, etc., and to prevent the passage of cold air when the coil or radiator is not in use. The habit is to neglect this damper, and in nine cases out of ten it remains permanently closed.

Baldwin evidently considers it a good plan to have some direct radiation, in addition to the indirect, in all school-rooms, the former to be used in very cold weather. He says this direct heating surface should be on the cold walls of a building or under the windows, so as to counteract the loss of heat from the bodies of the scholars, which radiates to the cold walls and glass, and also to prevent the fall of very cold currents of air from the glass to the floor, along which it usually flows to the outlets, etc., keeping the children's feet in a lower stratum of air a foot or so high, and ten or fifteen degrees colder than the air at the breathing or head line.

School-rooms for small children should have an ample system of indirect radiation that will admit from 500 to 1,000 cubic feet of air per hour per capita, and it should be so arranged that the regulation of the temperature will not lessen the air-supply. There are several good methods of accomplishing this known to heating engineers. The air should enter the room averaging in temperature from 80° to 100°, according to the outside temperature. In addition to this there should be the direct coils before mentioned.

For healthy youths or adults, as in your case, the air-supply should not be less than 1,500 cubic feet per capita, and if they are not confined to one position too long the addition of the direct coils is not so important.

The place for air to leave a room depends largely on the system of heating and ventilation used. When air enters through one or more large registers they may be near the floor or ceiling, according to circumstances, and if large quantities of air are admitted the position is not so very important.

When they are near the ceiling the flow of air from them should be directed to the coldest side of the room. When they are near the floor it is perhaps best to have them at the coldest side of the room, and they should have large area, so the current of air will be slow as it passes them. The air soon finds the ceiling and afterwards follows the same motions as it would were it admitted at a higher level.

The outlets for the systems just mentioned should be at the floor on the inner sides of the rooms, and the vent-flues are better in partition or at least warm walls.

In the designing of a building if it is inconvenient or impossible to get the heat-flues near the outer sides of the rooms, they may be put in the inner walls. If the outer walls are hard-finish, unfurred, and with much glass surface, then auxiliary coils are a great advantage for cold weather, as the two problems must always go together in cold climates—i. e., proper warming as well as proper ventilation.]

SANITARY REGISTRATION OF BUILDINGS IN LONDON.

A Bill to Provide for the Sanitary Registration of Buildings. Prepared and brought in by Mr. Lacasta, Dr. Fairquharson, Sir Guyer Hunter, Dr. Cameron, and Sir Henry Roscoe.

Be it enacted by the Queen's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in the present Parliament assembled, and by the authority of the same, as follows:

1. *Short title.*—This act may be cited as the Sanitary Registration of Buildings Act, 1887.

2. *Commencement and Extent of Act.*—From and after the first day of January, One thousand eight hundred and eighty-eight, the provisions of this act shall come into operation in the following parts of the United Kingdom, that is to say in the city of London, and in the area which is under the jurisdiction of the Metropolitan Board of Works; also in all other towns or districts within the area of a local authority under the Public Health Acts, of 2,000 inhabitants and upwards; and in any other district where the local authority shall adopt the act.

3. *Sanitary Registration Authorities.*—The corporation, local board of health, or other local authority charged with the administration of the Public Health Acts, shall become sanitary registration authorities under this Act for their respective areas, towns, or districts; and in every district where there may be no local authority under the Public Health Acts, or where there may be more than one local authority under the said Acts, the Local Government Board shall determine under what authority this Act shall be administered.

4. *Appointment of Sanitary Registrar.*—Each sanitary registration authority constituted by this Act shall appoint its clerk or some other person as sanitary registrar, who shall, under the direction of the sanitary registration authority, issue notices and certificates as required by this Act, and as given in the schedule hereunto annexed, and keep a record of the same in appropriate books to be supplied by the Local Government Board, and make such returns to the Local Government Board from time to time on approved forms as such Board may direct.

5. *Notices to Owner, Lessee, Sub-lessee, or Occupier.*—Previous to the first day of June, One thousand eight hundred and eighty-eight, each sanitary registration authority constituted by this act shall cause notice to be sent to the owner, lessee, sub-lessee, or occupier of every building occupied or intended to be occupied, either permanently or temporarily, within the area of its jurisdiction, informing the said owner, lessee, sub-lessee, or occupier of the provisions of this act (in the manner set forth in Form A in the schedule hereunto annexed).

6. *Sanitary Certificate to be Deposited.*—After the passing of this act the owner, lessee, sub-lessee, or occupier of every building used or intended to be used as a school, college, hospital, asylum, hotel, or lodging-house shall, and the owner, lessee, sub-lessee, or occupier of every other building, may cause to be deposited with the sanitary registration authority (in the manner set forth in Form B in the schedule hereunto annexed) a sanitary certificate, signed and sealed by a licentiate in sanitary practice, that is to say, a person or corporation duly licensed by the Local Government Board in accordance with this act.

7. *Licentiate in Sanitary Practice.*—The Local Government Board shall issue licenses in sanitary practice to the following persons and corporations, that is to say, (1) members of the Royal Institute of British Architects, members of the Institution of Civil Engineers, and members of the Royal Institute of Architects of Ireland, who are registered in accordance with this act as qualified in sanitary practice; (2) architects and civil engineers who have been in practice three years at the passing of this act, and who shall, before the first day of January, One thousand eight hundred and ninety, prove to the satisfaction of the Local Government Board that their practice as architects or civil engineers has been a bona fide one, and has included the designing and carrying out of constructive sanitary works; (3) sanitary associations incorporated by license of the Board of Trade; (4) medical practitioners registered as qualified in sanitary science; (5) persons who are medical officers of health at the passing of this act; (6) such other persons as the Local Government Board may consider qualified.

8. *Licenses in Sanitary Practice.*—The Local Government Board shall grant licenses in sanitary practice free of charge to members of the Royal Institute of British Architects, members of the Institution of Civil Engineers, and members of the Royal Institute of Architects of Ireland, who are registered in accordance with this act as qualified in sanitary practice, also to medical practitioners registered as qualified in sanitary science, and to persons who are medical officers of health at the passing of this act; for each other license granted under this act the Local Government Board may charge a fee not exceeding five guineas.

9. *Certificates of Competency in Sanitary Practice.*—The governing body of each of the following institutions, that is to say, the Royal Institute of British Architects, the Institution of Civil Engineers, and the Royal Institute of Architects of Ireland, shall issue certificates of competency in sanitary practice to the members of the institution who, in the opinion of at least five examiners appointed by the said governing body, are qualified to design and carry out constructive sanitary works, and for each certificate thus issued the said governing body may charge a fee not exceeding three guineas; and the said governing body shall deposit with the Local Government Board a duplicate of each certificate of competency in sanitary practice issued under its authority.

10. *Sanitary Arrangements to be Certified.*—It shall not be lawful for any person or corporation to sign or seal a sanitary certificate under this act for any building where the arrangements are not strictly in conformity with the following requirements—that is to say, (1) each water-closet shall have a flushing service, which shall be distinct and separate from every other water service, and no cistern shall be connected with any pipe which is in direct connection with a soil-drain; (2) each soil-pipe shall be ventilated above the highest window on the side of the building where the pipe is situated; (3) the drains shall be ventilated by means of a soil-pipe, or by a separate pipe above the highest window on the side of the building where the pipe is situated; (4) water-closets shall be trapped, and they shall be the only arrangements inside the building having pipes directly connected with a soil-drain; (5) there shall be an air-chamber with disconnecting syphon-trap, or an inlet disconnecting syphon-trap, which shall be easy of access, on the soil-drain between the building and the public sewer.

11. *Buildings not to be used unless Certified.*—After the first day of January, one thousand eight hundred and ninety, it shall not be lawful for any building to be used as a school, college, hospital, asylum, hotel, or lodging-house, either permanently or temporarily, unless and until a sanitary certificate has been deposited with the sanitary registration authority, and a sanitary registration certificate has been issued in accordance with the provisions of this act.

12. *Penalty for Giving False Certificate.*—Any person or corporation certifying the sanitary condition of any build-

ing under this act shall be deemed to have examined the arrangements certified, and for the issue of a false or misleading certificate shall be liable upon conviction before a justice of the peace to a penalty not exceeding ten pounds, with or without forfeiture of right to certify as may be determined; and every person or corporation willfully signing or sealing a false certificate under this act shall be guilty of a misdemeanor and punishable accordingly.

13. *Penalty for Letting or Occupying an Uncertified Building.*—Any owner, lessee, sub-lessee, or occupier of a building required to be certified under this act shall be liable if such building be not certified in accordance with this act to a penalty not exceeding ten pounds upon conviction before a justice of the peace; and for every day during which such building shall be occupied contrary to the provisions of this act, the owner lessee, sub-lessee, or occupier shall be liable to a further penalty of one pound, and these penalties shall be recoverable by the sanitary registration authority before a justice of the peace.

14. *Lapse of Certificate.*—After a period of five years from the date of any sanitary certificate or sanitary registration certificate under this act any such certificate shall lapse, and the building to which it refers shall be considered as uncertified; and in case of an alteration of or addition to any certified building which affects the operation of or access to the sanitary arrangements of such building, the said building shall be considered as uncertified; in each case the existing certificates must be endorsed or new certificates must be obtained in accordance with this act in the same manner as if the building had never been certified.

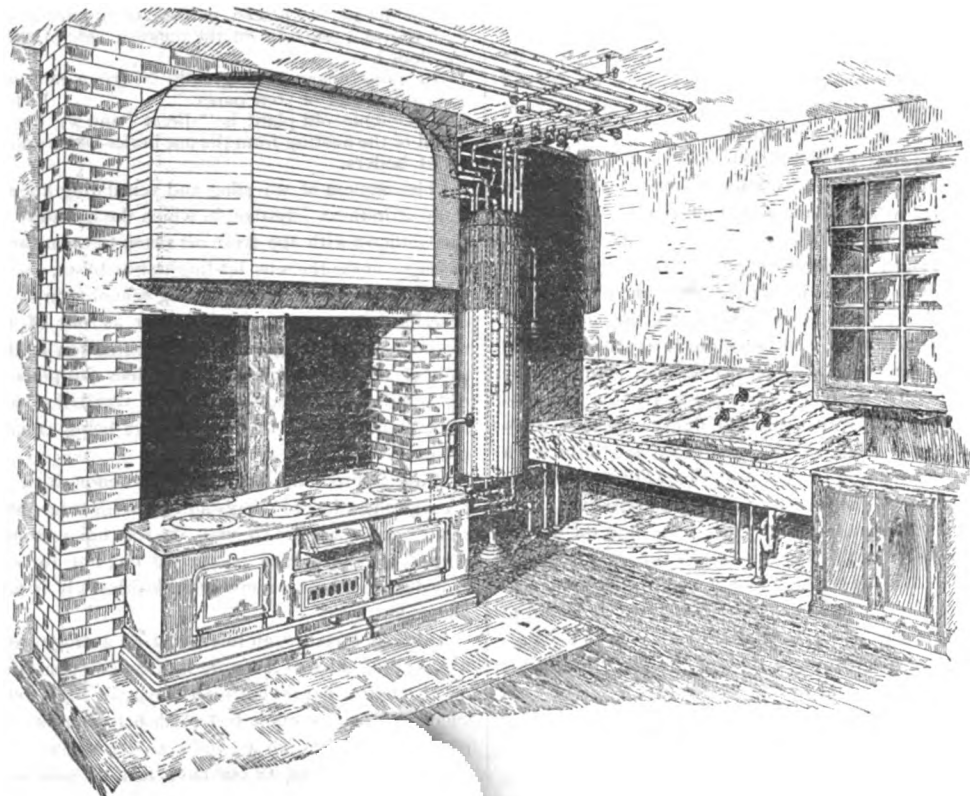
15. *Books and Forms to be Supplied by Local Government Board.*—All books required to be kept by this act, and forms for carrying out the act, also forms for making returns to the Local Government Board, shall be the same in all districts, and shall be supplied direct by the Local Government Board, except in cases where the said board shall otherwise direct; the cost of all books and forms supplied by the Local Government Board under this act to be paid by the local authority or institution receiving the same.

16. *Rights of Appeal against and by Local Authority.*—Each sanitary registration authority shall decide within its own area, town, or district, what buildings are being used as schools, colleges, hospitals, asylums, hotels, or lodging-houses; the decision of the sanitary registration authority shall, however, be subject to an appeal to a justice of the peace by the owner, lessee, sub-lessee, or occupier of any such building or by any ten ratepayers in the area, town, or district; provided that notice of appeal is given to the sanitary registration authority and a justice of the peace within fourteen days of the date of the decision objected to, and such notice of appeal shall state fully the grounds of objection; the decision of a justice of the peace shall only be subject to an appeal to the Local Government Board within twenty-one days, and the decision of the said Board shall be final.

17. *Act not to interfere with other Acts.*—This Act shall not be construed as in any way interfering with the Public Health Acts, or with any powers which the local authorities possess under any other acts, but in the absence of conclusive evidence to the contrary, the certificates issued under this act shall be regarded as proofs of the satisfactory sanitary condition of the buildings to which they refer.

KITCHEN BOILER ARRANGEMENT AT RESIDENCE OF H. C. FAHNESTOCK, ESQ.

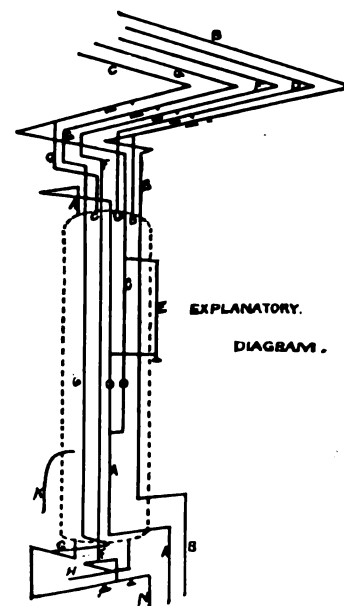
THE accompanying illustration shows the setting of kitchen boiler and pipes in the residence of Mr. Fahnestock, corner Madison Avenue and Fifty-first Street.



The boiler is a double boiler of heavy copper, with dome head, set on a Lockwood pattern stand, and holds eighty gallons. The pipes and fittings are all of polished brass. The hot-water supply pipes, both street and tank pressure, are each provided with a 1/2-inch return-circulation pipe. The pass-over pipe from the tank-supply has its inner valve within easy reach, allowing the street boiler to be filled from the tank at pleasure. The hot-water supply to the kitchen sink is taken below the floor and brought up again through the marble safe, which latter is carried around under the boiler as shown. The pipes where they are brought through the marble are finished off with neat polished brass flanges.

The pipes suspended from the ceiling are provided with wheel stop-valves and pet-cocks to allow either the shutting off or the emptying of the whole water-supply system. The kitchen sink is of porcelain, with slab, back, side, and apron of marble.

The safe is also provided with a marble surface.



EXPLANATION OF DIAGRAM.

- A. Cold-water supply to street boiler.
- B. Hot-water supply from street boiler.
- C. Cold-water supply to tank-boiler.
- D. Hot-water supply from tank boiler.
- E. By-pass for supplying street boiler from tank.
- F. Hot-water circulation-pipe on street-supply system.
- G. Hot-water circulation-pipe on tank-supply system.
- H. Water-back connection, cold.
- K. Water-back connection, hot.
- N. Sediment-pipe.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

MACHINE FOR TESTING STRENGTH OF BUILDING MATERIALS WANTED.

OFFICE OF INSPECTOR OF BUILDINGS,
CITY HALL, ST. PAUL, MINN., May 27, 1887.

SIR: Can you send me the name and location of some concern or firm where I can get a machine for the testing of the crushing strength of stone, brick, and the like? If you can give me the above information, you will oblige a subscriber to your valuable journal.

Respectfully yours, GATES A. JOHNSON.

[Referred to our readers.]

FLOOR FOR ALE BREWERIES AND PROTECTION FOR IRON FLOORS.

NEW YORK CITY, April 20, 1887.

SIR: If of interest to your subscribers, I would solicit replies to the following questions:

1. What makes the best floor for ale-brewers' storage and work rooms?

2. What covering do foreigners give to the iron floors they use for such purposes, to prevent the rusting of the iron?

Yours truly, ARCHITECT.

[1. The best material used for floors in brewer's storage and work rooms is composed of a foundation of concrete, upon which is laid one or two inches of natural rock asphalt, this material giving the most satisfactory work as stated to us by four of the largest brewing firms visited in this city, where the Seyssel, Neuchatel, and Lobsann rock asphalt has been used.

2. No iron is used for floors by Dreher, a large brewer in Vienna, nor by Truman, Hamburg & Co., manufacturers of London stout, but the material used is concrete and Seyssel rock asphalt.]

PLUMBING CATECHISM QUERY.

SPRINGFIELD, MASS., May 2, 1887.

SIR: Referring to "Plumbing Catechism," April 30, Question 17, why should not "such a pipe be put in"? What would be proper practice? Yours truly,

A. M. KNIGHT & SON.

[Referred to the Author of the "Plumbing Catechism."]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

A NEW STONE-BREAKING MACHINE.

A STONE-BREAKING machine is in use by the corporation of Burnley, Eng., for converting waste material, such as old granite sets, old flags, etc., into suitable material for road-making. The machine may be described as a combination of a "napping" motion stone-breaker, with a series of various-sized mesh sieves, arranged in a graduated scale from the largest downward. To these sieves is imparted a mechanical shaking action. The material passed through the stone-breaking machine is rendered into the largest series of sieves, which, after sifting, rejects the pieces that will not pass through, sending them down a shoot. This action is repeated down the whole series, so that the material rendered from the last sieve is a sharp, clean gravel or sand. Each shoot therefore deposits its separate heap of material of different sizes, ready for such purposes as it may be most suitable for, road-mending, bedding for cubes, grouting, etc. Mr. John Edward Stafford, the Borough Engineer, is the inventor of this machine, which is claimed to be much more economical and serviceable than the old system of breaking up rejected material by hand.

SEWERAGE OF CEDAR RAPIDS, IOWA.

WE have received from Mr. Chester B. Davis, of Chicago, the engineer of the works, a copy of the specifications, which seem to be quite full, and to have been carefully prepared.

AMERICAN PUBLIC HEALTH ASSOCIATION.

THE fifteenth annual meeting of the American Public Health Association will be held at Memphis, Tenn., November 8-11, 1887. The Executive Committee have selected the following topics for consideration at said meeting:

- I. The pollution of water-supplies.
- II. The disposal of refuse matter of cities.
- III. The disposal of refuse matter of villages, summer resorts, and isolated tenements.
- IV. Animal diseases dangerous to man.

The Local Committee of Arrangements at Memphis have already begun the work essential to a large and successful meeting. A circular will be issued in ample time before the meeting, giving full information in regard to transportation and hotel rates. All communications relating to local matters should be addressed to G. B. Thornton, M. D., Chairman Local Board of Health, Memphis, Tenn. For particulars address Irving A. Watson, of Concord, N. H., who is the Secretary.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
May 28.....	26.97	20.12	23.30	29.36	29.43	25.80	31.34

E. G. LOVE, Ph.D., Gas Examiner.

CONVENTION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE American Society of Mechanical Engineers began its session at Willard Hall, Washington, May 31, at 10 A. M.

The convention was called to order by the President, Mr. George H. Babcock, of New York City.

Chief Engineer Loring introduced Commissioner Webb, who extended a cordial and hearty welcome to the members, at the same time paying an appreciative tribute to the advance made in mechanical science.

The president of the convention, in response, said that the American people were hardly aware of the beautiful metropolis which the Capital City had become. The ultra worship of foreign ideals prevented many from admiring anything unless they see the trade-mark upon it of some foreign country. He thought that the Capitol building was the most beautiful structure of the kind in the world. He spoke of the splendid streets and avenues here, of their cleanliness, the beautiful residences and fine public buildings, which he said were only equaled by the warm hospitality of the people.

The business of the session was then begun, and the reading of the reports of committees called for. Mr. Henry R. Towne read the report of the committee on uniform tests and Mr. George M. Bond the report of the committee on standard threads for wrought-iron pipe, etc. The secretary, Mr. F. R. Hutton, presented the report of the council, which stated that, through Mr. Stephen W. Baldwin, the society has come into the possession of much of the expert apparatus belonging to the late Mr. John C. Hoadley, of Boston. There has been added to the library the Transactions of the Institutions of Mechanical Engineering of Great Britain from 1847 to date; also the Journal of the Iron and Steel Institute of Great Britain since 1873. He also reported that the following had been

ELECTED TO MEMBERSHIP:

Charles A. Ashburner, George S. Barnum, M. O. Beltingrodt, Frank M. Bigelow, William O. Bole, John Coffin, William E. Crane, George E. Dixon, Eliher Dodds, Seymour C. Dutton, Louis G. Engle, John M. Erwin, John R. Freeman, Stephen J. Geogheghan, Webster V. Gould, Robert Hardie, William F. Henry, James A. Horton, Edmund Kent, W. C. Lambert, Frank M. Leavitt, John F. Lewis, G. J. Mailleut, Albert H. Mansfield, John Metcalf, J. G. A. Meyer, J. O. Nicolls, Frederick V. Owen, Harry de B. Parsons, Frederick H. Prentis, Benjamin F. Radford, George S. Rider, J. T. Ridgway, Robert T. Herbert, Louis Schutte, Walter W. Scott, William Simpkins, Charles H. L. Smith, Charles Steel, Walter G. Stewart, Francis H. Stillman, John Thomson, George A. Tobey, Edgar G. Tuttle, Frank Van Vleck, Jesse Warrington, George E. Whitehead, John F. Wilcox, De Volsen Wood. Associate members: Thomas H. Brooks, James A. Gilkerson, Charles L. Huston, Albert A. Noye, W. C. Temple, A. F. Zahm. Junior members: Hugh V. Conrad, Alexander S. Garfield, William L. Lyall, Edward H. Mumford, S. Tompkins. Total, 60.

The president appointed the following committee to nominate officers: H. A. Ramsay, Baltimore, Md.; T. J.

Borden, Fall River, Mass.; W. H. Doane, Cincinnati; W. H. Weightman, New York; F. H. Underwood, Tolland, Conn.

The secretary read an invitation from Mr. John D. Ford to visit the Baltimore Training School, and also a communication from Mr. John W. Weston, Commissioner General for the United States to the Paris International Exposition of Railway Appliances and Industries, urging the society to co-operate in making that exhibition a success.

The following papers were presented: "Tests of comparative value of different kinds of belting," by Samuel Webber; "Should a piston packing ring be of the same thickness at every point," by L. H. Rutherford; "Systematic testing of turbines in the United States," by R. H. Thurston; "Helical seams in boiler-making," by R. H. Thurston. The reading of these papers was followed by discussions. The consideration of various topics of interest to the profession was then begun and occupied the remainder of the morning session.

The following names of members and guests were entered on the register of the society as present at the meeting: F. R. Hutton, Secretary, New York; George F. Babcock, New York; J. W. Sargent, Scranton, Pa.; Joseph H. Springer, Hamilton, O.; James A. Horton, Boston; F. L. Bigelow, New Haven; Thomas W. Capen, Stamford, Conn.; William Hewitt, Trenton, N. J.; J. M. Robinson and John Livingston, New York; Peter Kirkeverg, Youngstown, O.; Thomas R. Almond, Brooklyn; Charles H. Loring, Washington, D. C.; Charles T. Porter, New York; Alfred B. Couch, Philadelphia; John T. Hawkins, Taunton, Mass.; H. C. Francis, Philadelphia; George W. Weeks, Clinton, Mass.; Gustav Hillman, City Island, N. Y.; John F. Wilcox, Pittsburgh, Pa.; W. H. O'Dell, Yonkers, N. Y.; Moses G. Wilder and wife, Philadelphia; George F. Barrus and wife, Boston; Henry I. Snell and wife, Philadelphia; F. H. Stillman and wife, Brooklyn; A. C. Stiles and wife, Middletown, Conn.; F. H. Underwood, Tolland, Conn.; J. T. Ridgway, Trenton, N. J.; J. Q. Wright, New York; M. Gould, Norwich, Conn.; George M. Bond, Hartford, Conn.; George S. Strong, New York; William L. Lyall, New York; Edward L. Dent, Washington, D. C.; W. E. Stewart, Reading, Pa.; Thomas J. Borden, Fall River, Mass.; Charles Sperry, Fort Washington, L. I.; David Townsend and wife, Philadelphia; S. Tompkins, Crozet, Va.; E. C. Dicey, Chicago, Ill.; S. Ashton Hurd, Pennsylvania; E. H. Parks, Providence, R. I.; George E. Whitehead, Providence, R. I.; Richard W. Bailey, Pittsburgh; Baxter D. Whitney and daughters, Massachusetts; William L. Whitney, Massachusetts; Olie Scott, Bennington, Vt.; Daniel Ainsworth, Pittsburgh; J. G. Gilkerson, Homer, N. Y.; Charles W. Barnaby and wife, Salem, O.; J. A. Taylor, Wilmington, Del.; H. Van Duzen, Bayonne, N. J.; James Brady, Brooklyn; F. H. Richards, Hartford, Conn.; Edward H. Mumford, and mother, Omaha, Neb.; C. S. Dutton and wife, Youngstown, Ohio; L. B. Moore, New York; E. Fawcett, Alliance, Ohio; W. H. Wyman, Worcester, Mass.; H. S. Downe, Pittsfield, Mass.; Allen Sterling, New York; Grant Curtis, Pittsburgh, Pa.; J. F. Holloway, Cleveland, Ohio; Joseph Gobeille, Cleveland, Ohio; S. T. Wellmar, wife and daughters, Cleveland, Ohio; Thomas C. Sheldon, Boyleston, Mass.; Vincent G. Hazard, Wilmington, Del.; C. H. Woodbury, Boston, Mass.; A. Lorge and wife, Rochester, N. Y.; James Morgan, Jr., and wife, Johnstown, Pa.; Charles E. Emery and wife, New York; Albert Stearns, Brooklyn; Allen Stirling, New York; A. Plamondon, Chicago; James Mahony, New York; Wm. H. Weightman, New York; George Schuhmann, Reading, Pa.; J. A. Tilden, Boston; O. C. Woolson, Newark, N. J.; J. H. Webster Boston, Mass.; W. C. Mackinney, Philadelphia; A. C. Christensen, Brooklyn; S. Wilcox, New York; W. H. Wiley, New York; Morgan Brooks, Boston; Alexander Miller and lady, New York.

The afternoon was spent by the members, in visiting the Corcoran Art Gallery, the Capitol, and other points of interest.

A second session was held at 8 P. M.

[Remainder of report of the meeting will appear in our next issue.]

FIRST ANNUAL REPORT OF THE WATER-WORKS COMMISSIONERS OF KINGSTON, MASS. 1886.

These works cost, including land damages, \$40,894.15. Water is taken from a well 20 feet in diameter and 18 feet deep. This has never yielded less than 79,000 gallons per day. A Blake duplex pump, with 5-inch cylinder and 12-inch stroke, driven by a Burnham turbine 17-horsepower water-wheel, takes this through 240 feet of 8-inch suction-pipe, and forces it to a height of 196 feet and 900 feet distant to a reservoir 50 feet in diameter and 18 feet deep, built of brick with walls 2 feet thick at bottom and 16 inches at top, with a concrete bottom 16 inches thick; capacity, 265,000 gallons. There have been laid 8,738 feet of 8-inch pipe, 18,621 feet of 6-inch, and 13,574 feet of 4-inch, 5 fire-hydrants set, and 81 connections made. Present consumption is 10,000 gallons daily. Mr. M. C. French is superintendent, Mr. Arthur H. Howland, of Boston, was engineer, Mr. W. C. Boyce, of Worcester, engineer in charge, and Messrs. Thomas F. Meaney & Co., of Boston, contractors.

REPORT OF WATER COMMISSIONERS OF BINGHAMTON, N. Y. 1886.

During the year 10,103 feet of iron pipe have been laid, and 10,753 feet of cement-pipe have also been replaced by iron pipe, making a total of 21 miles of iron pipe and $7\frac{1}{2}$ miles of cement pipe now in use.

An experiment has been made of boring an 8-inch well to the depth of 1,000 feet, all but 30 feet of which was in the rock. The supply of water was inconsiderable, and the cost of the well was \$5,205.

To meet the emergency of a drought, a crib has been sunk in the centre of the Susquehanna River and joined to the pump-wells by a 30-inch pipe. At all ordinary times the supply from the wells is sufficient. The total cost of the crib and pipe was \$6,016, of which the pipe cost \$1,048.

The net earnings for the year were \$31,219. The total pumping capacity is 8,000,000 gallons per day, and the average amount pumped 2,459,525 gallons; average head pumped, 144 feet; number of gallons pumped for each cent's worth of fuel, 6,063; total cost for each 1,000,000 gallons raised one foot high, 4.03 cents; of which the fuel cost 1.14 cents. The duty was 53,994,000 pounds feet per one hundred pounds of coal.

Thirty hydrants, 20 meters, and 263 service-pipes have been added during the year. The 237 meters in use have cost an average of 67 cents each for repairs for the year. The system is the direct pressure, and fire-pressure was raised thirty times. Of the 14 breaks in pipes 13 were in the cement pipes.

Mr. D. Fetter is the superintendent.

MUNICIPAL REPORTS OF THE CITY OF NORFOLK, VA.

The municipal report of Norfolk is in the form of a message from the Mayor, Mr. Barton Myers, which shows the progress made by this thriving town. The sewerage system, originally built from plans of Col. George E. Waring, now comprises twelve miles of sewers, and has cost \$188,500. About one-fourth of the houses in the sewered section have been connected, and the amount of sewage and water now pumped is 590,000 gallons per day. The syphon devised by the City Engineer, Mr. W. T. Brooke, is working satisfactorily.

Large improvements in the water-service have been made under the direction of the Superintendent, Mr. H. L. Smith, and the average quantity of water now pumped is 1,440,853 gallons daily, with a yearly revenue of \$46,764.

Attention is called to the irregular manner in which the streets in outlying districts are being laid out.

The engineer recommends also that in the future all sewers be built by the city and by men under his control. No tabular statements of cost of pumping, etc., are given.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

At a meeting on Wednesday evening, June 1, 1887, President William E. Worthen in the chair, John Bogart Secretary, the secretary gave a résumé, prepared by himself, of the recorded experience with iron and wooden ties on railroads; the feature of the paper being a description of the "German system of permanent way with iron substructure." It was stated that several papers had been received, but the authors had prepared them to be read at the convention. It was announced that arrangements had been made with the trunk-line railways by which members attending the convention from the West who paid full fare on would, on presentation of a certificate that they had attended the convention, secure return ticket at one-third the regular fare.

The following were elected as members:

Frank Bruen (Cornell University, 1878), Civil Engineer, New Haven, Conn.; Henry Manson Byllesby, Pittsburg, Pa.; Samuel Barrett Cushing, Providence, R. I.; Herbert Clark Felton (Rensselaer Polytechnic, 1866), Secretary, Treasurer, and Superintendent Kaighus Point and Philadelphia Ferry Co., Camden, N. J.; Silas Bent Russell (Washington University, St. Louis, 1881), Engineer in charge of Water Distribution of St. Louis, Mo.; Robert Somerville (University Virginia, 1869), Assistant Engineer Board of Mississippi Levee Commissioners, Greenville, Miss.; William Parsons Watson (Yale College), Resident Engineer in charge of Location and Construction Montana Central Railway, Helena, Montana.

As Juniors:

Benjamin Douglas, Engineer of Bridges Michigan Central Railroad, Detroit, Mich.; Joseph Yendes Wheatley (School of Mines, Columbia College, 1886), Assistant in Chief Engineer's Office New York Central and Hudson River Railroad, New York City.

EXPLOSION IN A SEWER.

PHILADELPHIA has recently experienced quite an explosion in one of the main sewers, attributed to the ignition of sewer-gas. There is no doubt that Philadelphia sewers contain filth enough to generate a dangerous gas, but this particular explosion is probably due to leaks from some gas-main.

SCHOOL HYGIENE: THE LAWS OF HEALTH IN RELATION TO SCHOOL LIFE. By Arthur Newsholme, M. D. 143 pp., octavo. London: Swan, Sonnenschein, Lowrey & Co. 1887.

Dr. Newsholme is the Medical Officer of Health for Clapham and the Medical Examiner of Pupil Teachers to the School Board for London, so that he may be considered as good authority on the subject of which he writes. His book is a plain, sensible little work intended mainly for the information of masters of schools and of teachers, but well calculated also for the instruction of parents, whose intelligent co-operation with school authorities is so necessary to secure the best results. It is divided into two parts, the first relating to the sanitary desiderata to be kept in view in the site, construction, furnishing, heating and ventilation, and drainage of school buildings; the second treating of the studies, exercise, diet, etc., of scholars, with chapters on communicable diseases and accidents. The suggestions made under each head are in accord with modern sanitary science, and there is an agreeable absence of attempts at emotional exhortation and fine writing. One could wish that a little more had been said on some points. As, for instance, in speaking of dog-bites, and of the usual impossibility of ascertaining at once whether the dog is mad, it would have been well to note the importance of preserving the dog alive when this can be done, in order to secure precise information on this point, which would in many, in fact most, cases prevent unnecessary anxiety and worry. So also the advice that during a convulsion of epilepsy the patient should be "prevented from biting his tongue if possible," might well have been supplemented by a statement as to how this is to be done by placing something between the teeth, and the precautions needed to keep this something from falling into the throat and choking the patient.

These are very small defects, however, and we are glad to commend the book to all school teachers and trustees as well worth reading, and as a desirable addition to a school library.

MR. CONDER, Professor of Architecture at Tokio, Japan, says that there is nothing in the method of construction of the Japanese buildings which render them especially suited to withstand the shocks of earthquakes. Seismologically, they are exactly opposite to what earthquake buildings should be. They are extremely top-heavy to begin with, and have no ties or braces whatever of the ordinary kind. In the earthquake shocks common in Japan, the buildings sway about in the most alarming manner, and no earthquake advantages would ever be claimed in respect of these buildings. The pagodas might be likened to card-board houses having a central post put in the middle for the purpose of stiffening them; but it was curious that certain of these posts did not touch the ground.

PERSONAL.

MR. FRANK CROCKER and Mr. R. E. Smith, architects, of Chattanooga, have formed a copartnership under the firm name of Crocker & Smith.

ARTHUR BATE has been appointed Building Inspector of Milwaukee for the ensuing four years. He is an old Milwaukee builder.

ENGINEERS' CLUB OF PHILADELPHIA.

A REGULAR meeting was held May 21, 1887, President T. M. Cleemann in the chair; 33 members and 4 visitors present.

There was some further discussion of the form and arrangement of the proposed U. S. C. and G. Survey Map of the Delaware and Schuylkill Rivers near Philadelphia. The consideration of a resolution expressing the views of the club was deferred till the next business meeting.

The Secretary presented two communications from Captain S. C. McCorkle, embodying data on the "Retardation of the Tide in the vicinity of Philadelphia," etc. The Secretary presented for Mr. W. L. Hoyt, a multiplication table, from 1 to 25, for the Reference Book.

Mr. John L. Gill, Jr., presented an illustrated discussion as to whether the custom of upsetting the ends of bridge rods should be abandoned.

Mr. Arthur Marichal read an illustrated paper on the construction of reservoir walls.

Some discussion followed.

Mr. J. E. Codman presented a diagram for the regulation of dimensions, etc., of cast-iron flange-pipes, the object being to establish, upon the basis of mathematical proportions, the diameters of flanges and bolt circles, sizes and numbers of bolts and thickness of metal for different diameters of pipes.

Mr. Edward Hurst Brown described a test he had witnessed of fire-resisting paint.

Mr. R. Meade Bache exhibited a safety self-extinguishing car-stove.

ARCHITECTURAL COMPETITIONS.

PURSUANT to a resolution of the Board of Armory Trustees of Cincinnati, Hamilton County, O., architects are invited to submit plans, drawings, and specifications for the erection of an armory in the city of Cincinnati, upon a lot fronting 168 feet 8 inches on the west side of Freeman Street, 112 feet south of Flint Street, and extending west 300 feet to Denman Street, fronting 179 feet $4\frac{1}{2}$ inches thereon.

The armory must contain accommodations for a regiment of infantry, composed of twelve companies, and one battery of artillery, with accommodations for the various field and staff departments.

Plans will be received until noon of Wednesday, June 22, 1887, at the office of the County Commissioners. The board reserves the right to reject any and all plans. William B. Smith is the chairman of Board of Trustees, and E. Cort. Williams, clerk.

BRANCH COUNTY, MICH.—The supervisors are to consider competitive plans for a new court-house at Coldwater, cost not to exceed \$40,000.

COMPETITIVE designs are now called for the group of statuary that is to ornament the San Francisco City Hall, for which James Lick left \$100,000.

ENGINEERING COMPETITION.

SAN FRANCISCO, CAL.—The Board of Supervisors has postponed indefinitely the proposition to employ Colonel George E. Waring, Jr., to prepare plans for the city sewerage, and have decided to advertise for plans, specifications and a report embracing estimates of cost of providing a sewer system for the city. The author of the best plan will receive \$2,500; the next best, \$1,500, and the third, \$1,000. The first-prize man is to be supervising engineer and the others, first and second assistants in the order of their standing.

THE BENNINGTON MONUMENT.

THE monument to commemorate the battle of Bennington, near Bennington, Vt., has been awarded to Mr. W. H. Ward, of Lowell, Mass. The monument is to be paid for from funds contributed, \$40,000 by the general Government; \$25,000 by the State of Vermont; \$5,000 by the State of New Hampshire, and \$10,000 by Massachusetts. The pillar or obelisk, 308 feet high and 40 feet square at base, built of dolomite. Mr. S. H. Rinn, of Boston, is the architect.

THE Manufacturers' Association of Brass and Iron Steam, Gas and Water Work, which has been in successful operation for the past year and a half, has been recently strengthened by the formation of local associations of the dealers in plumbers' and steam fitters' supplies in the various cities. These local associations have for their object a closer intimacy between local competitors, that customs which have exercised a demoralizing influence on the trade may be done away with, and that through a permanent organization their interests may be identified with the Manufacturers' Association. The associations thus far formed are as follows: Boston—President, J. V. N. Stultz; Secretary, George Phillips. New York—President, John Simmons; Secretary, C. S. Stephens. Baltimore—President, Samuel Register; Secretary, F. X. Russell. Washington—President, Thomas Somerville; Secretary, E. G. Schafer. Pittsburg—President, W. B. Farrell; Secretary, J. Atwood. Cleveland—President, George Denning; Secretary, C. J. Hills. Detroit—President, Samuel Ferguson; Secretary, James Harvey. Cincinnati—President, F. Lunkennheimer; Secretary, George Clark. Chicago—President, John Clifford; Secretary, S. McKeeby. St. Paul—President, C. S. Rogers; Secretary, C. A. Fuller. Omaha—President, S. K. Felten; Secretary, H. T. Lally. Kansas City—President, C. C. English; Secretary, J. B. Rahn.

PUBLICATIONS RECEIVED.

IMPROVED PLUMBING APPLIANCES. By J. Pickering Putnam, Architect. With ninety-four illustrations. 8vo, pp. 220. New York: W. T. Comstock. Price, \$1.50.

THIRTY-THIRD ANNUAL REPORT OF BIRTHS, MARRIAGES, AND DEATHS in the State of Rhode Island for the year ending December 31, 1885. Prepared by Charles H. Fisher, M. D., State Registrar of Vital Statistics and Secretary of the State Board of Health. 2mo., paper, 198 pp.

SEVENTEENTH ANNUAL REPORT OF THE TRUSTEES OF THE COLUMBUS, OHIO WATER-WORKS, for the year ending March 31, 1887, together with the reports of the Secretary Superintendent, and Chief Engineer. A. H. McAlpin, Chief Engineer.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 5-6-7-8.

WATER, SEWERAGE, ETC.

JANESVILLE, WIS., May 26, 1887 (special).—The Mayor and Common Council of this city, subsequent to publication of notice to contractors, with specifications, by the Water Commissioners, granted a franchise of our water-works to Turner, Clark & Rawson, of Boston, and the Commissioners were compelled to notify contractors that no bids could be accepted, and none were received.

Turner, Clark & Rawson are to construct 13 miles of main, with 180 hydrants thereon, for \$4,200 rental, and \$25 rental for hydrants on extensions. They are to construct a reservoir of 700,000 gallons for storage purposes, and also a stand-pipe to furnish artesian water already provided by the city, but are to pay for the well. They are to furnish and supply four public fountains and supply churches and schools without charge; are to begin work by June 10, and finish in a year. Their engineer is now here.

CHATTANOOGA, TENN.—City Engineer Carey will make plans for an extension of the sewerage system, to cost about \$50,000. He will also make plans for new street-pavements, to cost \$150,000.

KNOXVILLE, TENN.—The Water Company has a contract with the Knoxville Car-Wheel Works for 1,000 feet of water-mains.

LYNCHBURG, VA.—City Engineer Fosburg will prepare plans for an extension of sewerage, to cost upwards of \$75,000.

CHATTANOOGA, TENN.—The Mayor says that it is absolutely necessary, for the health of the city that the sewerage system should be better, and that it would take \$200,000 to improve it. The City Council is in favor of using the first money to promote this object.

CHATTANOOGA, TENN.—The city water company has decided to invest upwards of \$100,000 in improvements. The pumping-station will be removed two miles up the river, a new building erected, and a new steam-pump purchased.

BAR HARBOR, ME.—The contractors for the new sewerage system for this city have given up the contract. It is alleged that the town failed to keep its part of the contract, and that the contractors have lost heavily, because they took the work too low. Operations will be resumed by the town authorities in a few days, but the work will not be completed until 1888.

MANKATO, MINN.—The Sewerage Committee are undecided in regard to the use of cement pipe.

NORFOLK, VA.—No agreement has been reached on the water question between the Water Company and the Council.

HAMILTON, ONT.—The town has not yet come to a satisfactory solution of its sewage disposal problem.

SAULT STE. MARIE, MICH.—A number of Chicago, Milwaukee, and Iowa capitalists, known as the Lacrosse Syndicate, have purchased the franchise of the St. Mary's Falls Water-Power Company. The organization has the right of way for a 150-foot canal through the town, and also owns a large amount of land available for mill and factory sites, docks, etc. Two extensive flouring-mills, of 1,000 barrels capacity per day each, and a large paper-pulp mill have decided to locate

here. The capital of the company is \$1,000,000, and the cost of the work is estimated at about that amount.

DARLINGTON, S.C.—A meeting was held in the Court-house recently to discuss the question of boring an artesian well. It was decided to bring the subject before the taxpayers as to whether bonds should be issued to be used as collateral for borrowing money for the purpose, and also for building a new town-hall and market-house.

COLUMBUS, O.—The water-works will be extended.

WINDSOR LOCKS, CONN.—The Windsor Locks Water Company has just been organized. Work will be commenced at once.

OLD ORCHARD, ME.—The contract for the Old Orchard water-works is signed, and a town meeting has been called to ratify it. The work is to be completed in July. Old Orchard agrees to pay \$1,000 a year for twenty years for 25 hydrants, with the privilege of purchasing the works at the expiration of ten years at an appraisal. At the expiration of the twenty years the water-works will be the property of the town. Work will be commenced as soon as the contract is ratified.

LITITZ, PA.—The Lititz Water Company has been chartered for the purpose of supplying water for public purposes. The capital stock is \$10,000. The directors are Isaac F. Bomberger, Johnson Miller, Great G. Erb, John P. Stauffer, and Samuel Scaber.

MANSFIELD, R. I.—The necessary petitions and charters have been granted by the Legislature for the establishment of a system of water-works here by the town or by a private company. The advocates of the project now propose to have another town meeting called soon, to give the voters in the proposed Water District another opportunity of accepting the charter and of building and owning the works, as it is thought by many that it will be a great saving in the end for the town to build the works. If at the next meeting the necessary two-thirds vote cannot be obtained, the Mansfield Water Company will proceed to build them.

PITTSBURG, PA.—A recent large fire has shown the necessity for an increased water-supply on the South Side.

PHILADELPHIA.—A Committee of the Councils is preparing an ordinance appropriating \$145,000 for sewers.

SOUTH BEND, IND.—W. M. Whitten, Commissioner of Drainage, advertises the letting of about thirty-five miles of ditches in Madison township in this county.

SUMTER, S. C.—The Town Council appointed a special meeting for last night to discuss the canal and water-works questions. An artesian well or a stream in the locality are sources under discussion.

MINNEAPOLIS.—It is proposed to build a new pumping-station in the Third Ward. Although a commission has condemned lands for the site, a number of Aldermen contend that the establishment of a pumping-station as far south as the Third Ward will be a useless waste of money. They contend that to obtain a supply of pure water it will be necessary to locate the new pumping-works above the mouth of Shingle Creek.

DOVER, ME.—The engineers have been here surveying for the Water-Works Co. and have gone home. There are rumors afloat that there is a disposition on the part of the contractors to throw up the contract.

MADISON, WIS.—\$15,000 is to be spent on new water-mains this year.

BURLINGTON, IOWA, will put in Hyatt filters for its water-supply.

TOLEDO, O.—In order to judge of the advisability of accepting the proposition of Colonel Lemert, who wishes to purchase the water-works, the city will receive informal bids for buying the works.

SAVANNAH, GEO.—The press is discussing an increase of the city water-supply.

CONCORD, N. H.—The Water Commissioners have voted to extend the water-works to Pena-

cook the present season. Goodhue & Birnie, of Springfield, Mass., were awarded the contract at \$37,500. Work will be begun September 1.

The work at West Concord was reported to be substantially completed with the exception of setting the hydrants. It was voted to lay a line of pipe from the dam to the stone church immediately.

It was also decided to begin at once to extend the works to St. Paul's School. About 7,500 feet of pipe will be required for this.

The laying of a 12-inch pipe from Franklin Street to Pleasant Street through Rumford Street, and of 1,800 feet of pipe in Blossom Hill cemetery was voted. It was decided to lay pipe in Woodlawn cemetery at Penacook if it is needed.

Contracts for all the work have been made with Goodhue & Birnie.

INCORPORATED is the San Fernando Valley Improvement Company. The object is to buy, improve, and sell real estate, acquire water and water rights, build ditches, etc. The directors are, W. B. Barber, George R. Crow, F. C. Howes, R. R. Brown, and Frederick C. Howes. Capital, \$2,000,000.

BERTHOUD, COLO.—Ground has been broken in the streets of the town for the new water-works, which will shortly be completed.

HELENA, MONT.—Work on the water-works is to be begun here at once. Mr. Woolston, representing the builders, is now in Chicago purchasing material.

PALMYRA, N. Y.—A large vein of pure water about a foot in diameter was found by water-works contractors who are expecting to put in a system of works here. All that has been needed was good water. The village board held a special meeting May 27, and steps will be taken to start plans at once.

NEWARK, WAYNE CO., N. Y.—The construction of the water-works will be commenced next week.

THE Worcester water company, of Otsego County, N. Y., is incorporated with a capital of \$35,000. Members are H. H. Smith, Julius T. Headsell, Silas W. Ferguson, George Hardy, James Johnson, M. H. Nichols, Herman Wagoner, and B. Brown, all of Worcester.

ORANGEBURG, S. C.—The council have entered into an arrangement with Mr. George H. Cornelison, proprietor of the Orange Cotton Mills here, whereby the work of erecting a system of water-works is to be begun at once. The agitation of this question was begun less than two weeks ago. The only question with the City Council was as to how the necessary money should be raised.

SUMNER, WASH. T.—Nearly \$4,000 have been subscribed, and some of the citizens of Sumner will incorporate the Spring Branch Water Company. The capital stock will be \$10,000. The directors will be I. F. Thompson, E. C. Meade, W. R. Lindsay, John Kincaid, and L. N. Hudson. The object of the company is to build and construct a water-works system for public and private use at Sumner. The reservoir will be located somewhere on the hillside, and one and a half miles of 6-inch main will conduct the water under 150-foot head to the town.

SUMTER, S. C.—The Council is discussing the question of water-works.

ST. PAUL.—The Water Board has advertised for bids for clearing out the grounds for the new high-service reservoir. It will have an elevation of 300 feet above the river and 600 feet above the highest service on St. Anthony Hill, and will have a capacity of 35,000,000 gallons.

THE Vineyard Haven, Mass., Water-Works Company are laying pipes to bring the spring-water from Lake Tashmoo.

HAMILTON, ONT.—The City Council has made an appropriation for a small lot of water-pipe and fittings.

TYLER, TEX.—L. B. Fish, of St. Louis, Mo., H. H. Rowland, H. G. Askew, B. W. Rowland and J. J. Daglish, of Tyler, will incorporate as the Tyler Water Co.

APPLETON, WIS.—The construction of a reservoir will be begun immediately by the water-works company.

MARION, KAN., has made arrangements for a \$60,000 water-works and an electric-light plant.

BOOTHBAY, ME.—On May 28 Boothbay Harbor voted to have water-works. The Gardiner Water Company has the contract.

MADISON, WIS.—The Beaver Dam Water-Works Company; capital stock, \$100,000; incorporators, Ego Ferris, Joseph W. Reade, and Mark A. Warren.

CAMDEN.—The Pavonia Water-Works, which supply the city of Camden, are to be enlarged, and the city will advertise for a new pump of 10,000,000 gallons capacity per day.

NORTH EASTON, MASS.—Governor Oliver Ames, Frederick L. Ames, and Dr. George B. Cogswell have been elected Water Commissioners and instructed to proceed to build a works at once and make the necessary contracts therefor. The cost will be about \$60,000.

THOMASTON, ME.—A contract has been signed between the citizens of Thomaston and the Camden and Rockland Water Company, providing for the bringing of a water-supply into this town.

EUFALA, ALA.—J. H. Hartley, of Montgomery, Ala., has received the contract to erect a stand-pipe for the water-works.

CEDARTOWN, GEO.—The city will petition the Legislature for authority to issue \$10,000 of bonds to build water-works.

MACON, GEO.—Jesse W. Starr, of Philadelphia, will make a proposition to build water-works.

ASHLAND, NEB., will open bids at 2 o'clock P. M., June 16, for a system of water-works to cost \$13,000. A. A. Richardson, of Lincoln, Neb., is the engineer.

SACRAMENTO, CAL.—The Eldorado Water and Deep-Gravel Mining Company propose to bring a canal into this county thirty feet wide and six feet deep, capable of supplying thirty thousand inches of water, which will irrigate a territory of two hundred thousand acres. This canal will be thirty miles long, and besides irrigating lands will furnish power for manufactures in this city.

CHESTER, PA.—The South Ward Water-Works recently leased by the city have been sold to the new Chester Water Company, a corporation composed of capitalists from this city, Philadelphia, and New York. The new Chester Water Company was organized two years ago, and has a plant of considerable magnitude in construction. The old and new systems will be combined.

TOWSON, MD.—The Towson Water Company have let the contract to bore an artesian well and furnish and lay pipes to the Miller Artesian Well Co., of Baltimore.

CHATTANOOGA, TENN., will issue \$50,000 of bonds for sewerage and street improvements.

CALERA, ALA.—The Calera Land Co. have commenced work on the reservoir and wells, and are now ready to receive bids on 6 and 4-inch iron pipe delivered here.

FORT SMITH, ARK.—A. L. Pogue has just completed the improvements to the water-works here, consisting of a large new pump-house, relaying a 20-inch suction pipe, laying a 16-inch main, and putting in a new Worthington pump of 4,000,000 gallons capacity in 24 hours. This, with old pumps, will give pumping capacity of over 6,000,000 gallons per day. The new improvements cost over \$100,000. This, with the original work, will cost \$230,000.

GAS, STEAM, BUILDINGS, ETC.

WOONSOCKET, R. I.—The Woonsocket Electric-Light Company have increased their capital stock from \$50,000 to \$100,000, and will furnish power for the electric street-railway.

PITTSBURG, PA.—The Phila. Company has commenced laying pipes to supply Parnassus with natural-gas, and this week the same company will continue the work of piping Etna borough.

NEW INCORPORATION.—The Hunter Electric Company of Philadelphia, capital, \$100,000. The directors are, Rudolph Hunter, John W. Henderson, William L. Wharton, Jr., Edward Samuel, of Philadelphia, and Wharton Barker, of Jenkintown.

The Central Cast Iron Company, of Minneapolis, has been incorporated by C. C. Joslyn, W. P. Buell, C. J. Betts, D. A. Pool, G. D. Cord, Charles S. Sedgewick, Jerome Lucas, and C. P. Beard. The capital stock is \$1,000,000.

PORT TOWNSEND, WASH. T.—A movement is being made by the citizens to incorporate an Electric-Light Company with a capital of \$15,000.

NASHVILLE, TENN.—The Alexander Iron Company has been organized with a capital of \$1,000,000, to erect works for manufacturing iron at Nashville.

INCORPORATED is the Severance Nail Machine Company of St. Paul. Capital stock, \$100,000. Incorporators: G. K. Shaw, Minneapolis; J. H. Woolsey, John A. Berkey, St. Paul; W. N. Severance, Appleton; S. S. Murdock, Murdock.

ROCHESTER, N. Y.—It is understood that the Lamp Committee of the Common Council will recommend to the Council that the entire oil district be lighted with electricity, and that a contract be entered into for the immediate introduction of electricity into all the outer wards. It is said that the committee has received bids for lighting the entire city with gas exclusively at figures aggregating \$40,000 less than the present cost of lighting the streets of the city. The Brush Electric Light Company, it is said, has made a proposition much more favorable to the city than the present contract and in which they also agree to give up their present contract, furnishing both the new and the old territory at about two-thirds the present rate. The Edison Company underbids the present cost of gas, and the Rochester Electric Light Company also desires a share of the contract.

MANCHESTER, VA., is putting in an electric-light plant, the buildings for which will be erected according to plans of Westinghouse, Church, Kerr & Co., New York.

THE Equitable Gas Company of Springfield Ill., has been incorporated. President, H. M. Phillips; treasurer, Emerson Wight. The capital is \$250,000.

YANKTON, DAK.—The contract for putting in the works of the Grand Forks National Gas Company was let Tuesday to the National Gas-light and Fuel Company. The capacity of the works is 175,000 cubic feet every twenty-four hours. The Springer system has been adopted.

KEENE, N. H.—The city has contracted for twenty electric lights of the American system, to be introduced July 1.

JERSEY CITY, N. J.—The Therostatic Steam-Heating Company, whose articles of incorporation have been filed in the County Clerk's office, has been organized for the purpose of introducing a patented process of steam-heating. The capital stock of this company will be \$150,000, of which only \$1,800 has been subscribed for and is held by Joseph E. Culver, M. D., Abel I. Culver, Thomas R. Withers, and Abel I. Smith, all of this city.

MAYSVILLE, KY.—The Maysville Natural Gas Company have contracted with R. W. Evans to sink a well 1,200 feet deep.

CLEVELAND, TENN.—A company has been formed to build gas-works.

FORT WORTH, TEX.—The capital stock of the Fort Worth Natural-Gas and Artesian Water Company is \$25,000. The company will shortly commence boring for gas.

TYLER, TEX.—R. Bergfeld and others have been appointed a committee by the City Council to negotiate for the erection of gas-works.

RICHMOND, KY., has recently had organized and incorporated a company for the purpose of boring for natural-gas. The company has been organized, officers elected, and all the stock fully paid in.

COLUMBUS, MISS.—J. R. Ryan will enlarge the gas-works and put them in thorough repair.

KEY WEST, FLA.—The Key West Gas Company will erect an electric-light plant at once.

RAILROADS, BRIDGES, CANALS.

MILWAUKEE.—Incorporated is the Milwaukee Cable Railway Company. The capital stock is stated at \$300,000. The incorporators are William P. Mc Laren, George W. Mitchell, and John A. Hinsey.

MILWAUKEE.—The Blue Mound Street Railway Company are receiving bids to construct the proposed line from Forty-sixth Street across the viaduct to the first cross-road beyond the Calvary Cemetery.

MILWAUKEE.—Ordinances were introduced giving franchises to two more railroad companies. One to H. M. Benjamin and others; another to L. F. Frisby and others, for a horse or cable line.

NEW YORK.—A new railroad between New York and Boston is projected; the total cost will be nearly \$20,000,000. William T. Block, President; D. C. Linsley, Engineer; C. E. Brown, Secretary.

PITTSBURG, PA.—A \$200,000 tunnel will probably be built here. Address the City Engineer.

NEW HAVEN, CONN.—The Committee on Railroads and Bridges has voted to recommend a new iron bridge over the railroad tracks at Olive Street, the cost be divided between the city and Consolidated road. The committee also voted to recommend the purchase from the Consolidated road of another span of the worn-out Housatonic bridge for \$10,000, in order to complete Tomlinson's bridge.

BELOIT, KAN.—A line of street-railway is being built here.

TOPEKA, KAN.—A Boston syndicate has bought the Topeka city railway, and will spend \$200,000 in developing and extending the system.

TRENTON, N. J.—A new iron bridge of 150 feet span over the Delaware, Lackawanna and Western Railroad and Morris Canal, near Hopatcong station, will be built on the new road leading from Drakesville to Lake Hopatcong.

RAILROAD BRIDGE.—The Gloucester County, N. J., Board of Freeholders has decided that the new bridge which is to be built over the Raccoon Creek, between Swedesboro and Bridgeport, shall be 140 feet long, 16 feet wide, with an 88-foot draw. Estimates for both an iron and a wooden structure will be asked for from builders.

DULUTH.—The St. Louis River Water-Power Company will build a dam. Holyoke, Mass., parties will erect linen and wood-pulp mills as soon as dam is done.

THE Minneapolis Terminal Railway Company has filed articles of incorporation. Capital, \$1,000,000. Incorporators: Calvin L. Goodrich, Charles F. Hatch, L. A. Harris, Henry C. Truesdale, and Charles D. Hammond. The object is to construct a belt railway around the city.

ST. PAUL.—The City Council opened bids last week for the substructure of the up-town bridge from Forbes Street to Mohawk Avenue as follows: Arthur McMullen, \$136,119; Charles Lauer, \$159,645.75; Patrick Durack, \$175,067; A. J. Jolberg & Son, \$197,781.50; T. Saulpaugh & Co., \$158,832. The bid of Arthur McMullen was accepted, and the City Attorney, with the City Engineer, was instructed to execute a contract. The City Engineer submitted plans for the Snelling Avenue bridge, to be built by the Milwaukee road, which were approved.

HELENA, MONT.—G. W. Griggs, A. G. Foster and others have incorporated the Montana and Cœur d'Alene R. R. Co. with a capital stock of \$1,000,000.

The plans for the construction of the pontoon bridge, 680 feet in length, were made recently by E. H. Bramhall, of Camden, N. J., and sent to Curacao, W. I. Mr. Bramhall has been notified of the acceptance of his plans and requested to make figures, which he has done. The bridge would require seventeen boats, strongly built and copper fastened, and would cost from \$20,000 to \$25,000.

A new electric railway company has been organized to put in a street-railway in South St. Paul, under patents of the Enos Electric Railway Supply Co. Incorporators: Arthur E. Clark, Charles W. Clark, Thomas T. Smith, James W. Imeson, Daniel D. Merrill, Albert M. Lawton, Charles H. Lienau, George H. Staples, and Norman T. Bryant, all of St. Paul. The capital stock is fixed at \$500,000 and the principal place of business is St. Paul.

KINGSTON, N. Y.—A meeting of the directors of the Delaware and Otsego Railroad Company was held here. Thomas Cornell, of this city, was elected President; Samuel W. Andrews, of New York, Vice-President; Samuel G. Dimmick, of Kingston, Secretary and Treasurer. The building of the road will be begun at once.

PITTSBURG, PA.—The Pennsylvania railroad contemplates building a bridge across the Ohio River, at Nimick Station, four miles below Pittsburgh.

MISCELLANEOUS.

CHICAGO, ILL.—Commissioner of Public Works George B. Swift asks bids until June 8 for a quantity of granite and cedar blocks.

MILWAUKEE.—A 6-hatch crane for discharging ore at the Rolling Mill dock, in Bay View, will be built. North Chicago Rolling Mill Company, Milwaukee, Wis., are the owners. A \$25,000 public bath-house will be built.

OTTAWA, CAN.—A delegation from the Toronto City Council, consisting of Alderman Boustead, Chairman of the Executive Committee, and Alderman Baxter, arrived in the city May 26. The object of their mission is to interview the Government in relation to the commencement of the harbor improvements and the erection of a new drill shed in that city. The corporation is willing to contribute \$100,000, which is half of the estimated cost of the former work, and to provide a site for a new drill hall.

MINOT, DAK.—An extensive mica bed has been discovered seven miles from this place.

MONTGOMERY, ALA.—Work was begun on an iron furnace at Riverside, a suburb of Montgomery. It is the first furnace and the only one being erected in the Black belt of Alabama. The corner-stone of the furnace will be laid on July 4.

MESSRS. MORRISON & MASON, of Glasgow, have been awarded the contract at £129,973 3s. and 6d. for constructing the first portion of the new water-supply scheme for Manchester, England, which involves the tapping of Lake Thirlmere. A large amount of tunnel-work is also to be done in connection with this scheme.

CLEVELAND, O.—The Cleveland Hydraulic Dredging Company, capital stock, \$50,000, has been incorporated by P. W. Rice, Fred Hempy, W. P. Cowan, B. F. Morse, and Frank Rieley.

SAVANNAH, GEO.—Clifton Manufacturing Company will build an additional cotton mill at a cost of \$300,000.

TUCSON, ARIZ.—A water ditch, to cost \$20,000, will be constructed here.

INCORPORATED is the Henry Martin Brick Manufacturing Company, of Lancaster, Pa. Capital, \$150,000.

TACOMA, WASH. TERR.—Plans are now being prepared at Washington for the new light station at Destruction Island, for which an appropriation has already been made by Congress. Destruction Island is situated on the northern coast line, about midway between Gray's Harbor and Cape Flattery. This new light-house will cost about \$85,000. Attached to the station will be a fog signal. The main tower, which will consist of iron, will be 85 feet high. Bids for the contract to construct this station will be advertised for by Captain Powell, the construction engineer, before long. It will be a first-order light.

BIDS OPENED.

BOSTON.—The following proposals were received May 26 for the mason-work of the Horace Mann school-house, to be located on Newbury Street: Abraham Ripley, \$38,887; R. R. Mayers & Co., \$37,488; J. H. Coon & Co., \$38,100; Donahue Bros., \$41,000; D. H. Cram, \$30,990; Edward Lynch, \$39,500. The contract was not awarded, as the proposals were all in excess of the appropriation.

MOHAWK, N. Y.—Two extensive contracts have just been awarded to Messrs. Brown Brothers, of Mohawk, one at Cohoes, from Cohoes Water Company, amounting to \$60,000, for masonry and earth-works in extending and repairing canal No. 3, and one for dredging at Covines Folly, Hudson River.

MINNEAPOLIS.—The following bids were received by the Board of Education last week

for additions to the high school: L. C. Bisbie, \$47,895; J. R. Quigley, \$43,985; F. A. Fisher & Co., \$43,622; A. Dinsmore & Co., \$43,150; H. E. Selden, \$43,000; R. McMillan & Co., \$42,850; Haglin & Morse, \$41,796; H. N. Leighton & Co., \$37,200. The contract was awarded to the lowest bidder, H. N. Leighton & Co.

PHILADELPHIA.—The lowest bid for lining the East Park Basin was that of the American Artificial Stone Paving Company, which amounted to \$65,277.74. The Vulcanite Pavement Company's bid for cement covered with Neuchatel asphalt was \$68,364.75, which Dr. Gilbert was willing to guarantee to be waterproof for at least three years.

LITCHFIELD, CONN.—The contract for the construction of the new Mansion House block has been let to J. N. Robertson and Francis P. Rice, of Danbury, for \$22,000.

WALDEN, N. Y.—The contract for building a two-span bridge at this place has been awarded to the Iron Bridge Co., of East Berlin, Conn., for \$13,900.

CINCINNATI.—Contract for paving Baymiller Street awarded to G. Eyermann & Co., at \$97,806.72.

ALBANY, N. Y.—Superintendent of Public Works Shanahan has awarded the contract for dredging 30,000 cubic yards of material from the river at Round Shoals and 1,000 cubic yards at the upper railroad bridge to John Brown, of Mohawk, for 22½ cents per cubic yard. The other bids were: Round Shoals—P. W. Myers, 44.7, and E. M. Payne, 43.9 cents; and the railroad bridge, E. M. Payne, 43½, and Robert Jones, of Cohoes, 48½ cents per cubic yard.

TOPEKA, KAN.—The following are the bids submitted to the Board of Regents of the State Normal School for erecting the new wing to the present building: L. D. Eversole, Topeka, \$24,536; John Hammond, Emporia, \$20,245; J. M. Anderson, Emporia, \$21,850; E. F. Sprague, Emporia, \$24,835. The contract was awarded to John Hammond.

Following are the bids for the plumbing, heating apparatus, etc.: Griffith & Ewing, Emporia, \$4,708; D. C. McMurtrie, Emporia, \$4,500; M. E. Herbert, St. Joseph, \$5,000; S. I. Pope & Co., Chicago, \$4,898; Sheehan & Jacobs, Topeka, \$4,300; McCarthy & Sheehan, Topeka, \$4,485. The contract was awarded to Sheehan & Jacobs, of Topeka.

The work of construction will commence at once and be prosecuted to final completion.

WASHINGTON.—The contract for completing the terrace and grand stairways at the Capitol was awarded to the Vermont Marble Company for \$123,700.

AMSTERDAM, N. Y.—The contract for fifteen miles of sewers was let as follows: Benjamin Van Vranken, Schenectady, section two; Stanton & Doyle, Cohoes, section three; Brown & Buckley, Mohawk, section four; Sherman & McDonough, West Troy, sections five and six. Charles A. Miller & Son, Utica, contract for material for five miles at \$34,126.74. Work will be begun at once.

DETROIT, MICH.—Bids for paving Beaubien Street, from Jefferson Avenue to Congress Street, with cedar blocks and stone gutters, were opened yesterday by the Board of Public Works, as follows: Eugene Robinson, with Berea stone curbing, \$1,481.54; with Medina stone curbing, \$1,629. S. R. Thompson, with Berea stone, \$1,760.77; with Medina stone, \$1,849.78. Leadbeter & Stewart, with Berea stone, \$1,657.87; with Medina stone, \$1,786.44. H. Brossard, with Berea stone, \$1,755.46; with Medina stone, \$1,824.69. Talbot Paving Company, with Berea stone, \$1,938.34; with Medina stone, \$2,037.22. H. Meridian, with Berea stone, \$1,490.77; with Medina stone, \$1,819.36.

Bids for paving Cherry Street from Fourth to Trumbull Avenue: Leadbeter & Stewart, with Berea stone, \$8,455.01; with Medina stone, \$8,941.47. S. R. Thompson, with Berea stone, \$8,735.79; with Medina stone, \$9,030.19. Talbot Paving Company, with Berea stone, \$9,078.63; with Medina stone, \$9,450.52. H. Meridian, with Berea stone, \$8,857.12; with Medina stone, \$9,335.75. Eugene Robinson, with Berea stone, \$8,571.24; with Medina stone, \$9,154.64.

Bids for furnishing the District Government one portable 4-inch pumping plant, including engine and boiler complete, ready for use opened May 18: Joseph Edwards & Co., 414 Water Street, N. Y., \$935; S. C. Forsaith Machine Co., Manchester, N. H., \$827.50; Lawrence Machine Co., Boston, Mass., \$1,425.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 2. } PUBLISHED EVERY SATURDAY.

NEW YORK, JUNE 11, 1887.

LONDON, JUNE 25, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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ROCHESTER ENJOINED FROM DISPOSING OF ITS SEWAGE TO DETRIMENT OF A NEIGHBOR.

THE Court of Appeals of this State has just rendered an important decision in reference to the powers of a town in the matter of the disposal of its sewage.

The city of Rochester discharged its sewage into an open drain which it had constructed across lands situated within the adjoining town of Brighton, and in such wise as to create a nuisance. The town Board of Health thereupon issued an order prohibiting this use of the open drain, but having no power to go within the limits of the city of Rochester and abate the nuisance by preventing the discharge of the sewage, it brought suit in court against the city for an injunction restraining the discharge of the sewage into the open drain without its own limits and within the boundaries of the adjoining town of Brighton. The Court granted the injunction, and upon ultimate appeal to the Court of Appeals the action of the Court below has been sustained.

This seems to be an eminently just decision. One town or city ought not to perfect its own system of sewerage to the detriment of its neighbor.

THE NEWARK IMPROVED SEWERAGE.

WE recently devoted considerable space to illustrate and describe the recent work in connection with the improved sewerage system of Newark, N. J. It seems timely, therefore, to remind the authorities of that city who look for relief from the almost unbearable nuisance caused by the deposit of sewage on the meadows, from which it has suffered so long, that the new structure has been designed as the first step of a comprehensive system which must be carefully followed and developed as the city grows in size, and to call attention to the necessity of making all the features of the new settlement, which, it is expected, will steadily advance on the meadow, conform to the requirements of the new sewerage system.

We regret to hear that no active steps have been taken by the city government to regulate the grade of the streets adjoining the meadows, when it is obvious that the ultimate success of the improved sewerage system depends to a large extent on proper grading of that district.

The necessity of a perfect adaptation of the street-grading to the system of sewers is shown in the following extract from the report of Mr. A. Fteley, the Consulting Engineer, who recommended the new sewer (July, 1884):

The system which has just been submitted to you provides a way for the disposal of the sewage for the present and for the future, but its success is contingent upon the following conditions:

First—The present street sewers must be properly connected, as they are built, with the collecting sewers.

Second—The grading of the streets must be done in such a manner as to accommodate the sewerage system.

The first point need not be developed.

The second may require some explanation.

Some parts of the built parts of the city in the vicinity of the meadows, either on solid ground or on filling, are now too low. The flow in the sewer is not satisfactory and the water stands in the ground too near the surface. This condition of things is universally admitted as the cause of disease and may work against the success of the drainage system at those points. The grades of the streets in parts

now settled upon near the meadows (wherever practicable) and in the new portions to be filled up should be fixed beyond question.

The elevation of the proposed grading cannot be finally fixed until a careful study has been made of the system of sewers to be built in connection with the proposed collecting system, but the elevation of the surface should not be less than seven or eight feet above high-water mark; no less an elevation, it is thought, would be recommended by your sanitary advisers.

Whatever be the decision of your City Council in regard to the sewer system now recommended, the question of a perfect adaptation of the street-grading to the system of sewers is of such consequence that I would suggest as an important part of the recommendations which you expect from me, that a study should be made of it, in order to enable you to regulate the further advance of the settlement of the city on a fixed basis. Without giving in detail the final arrangement of the sewers through the streets which must be drained in the near future, it may be said that the same mode of disposing of sewage as is now proposed for the existing sewers may be adopted; or it may be found preferable, in order to reduce the height of filling, to resort to a double system—viz., one system of drain-pipes directly connecting the houses with the collecting sewer, and one system of surface sewers, with small inclinations, to be connected with the meadows or with the storm-sewer when the time comes to build it.

These recommendations should be followed, otherwise, when too late, the city will find it has lost a large part of the advantages the construction of the improved sewerage would have secured.

FOOD PRODUCTS IN NEW YORK.

AT a time when daily newspaper enterprise is largely directed to secure articles for publication that are alarming and sensational in their character, it is a matter worthy of commendation that the New York *World* has been at considerable expense to place before its readers a reliable and authoritative report of the condition of food products in this city, with reference to the character and extent of their adulteration. Instead of going about the matter so as to be able to publish sensational articles such as filled the daily papers a few years ago when we were active in promoting legislation to check the evil, the *World* employed Dr. Edward G. Love, late Analyst of the New York State Board of Health, who is specially qualified for a work of this character, to undertake the examination of a large number of samples, all of which were secured in such a way as to fairly indicate the character of the groceries sold in the tenement districts of this city. The first installment of Dr. Love's report appears in the *World* of June 5, and gives the particulars of several hundred samples, in each case stating from whom the sample was bought. We advise Health Boards and all persons interested in these matters to procure copies of the *World*, as these reports will be a valuable contribution to the literature on this subject. It is gratifying to note, as the *World* says, that "the grocers of this city are really dealing honestly with their customers, and that the number of instances in which adulterations have been detected is comparatively few, and of the false weights fewer still." The adulterations that were found to exist were mainly such as affect the pocket and not the health, and this, as our readers will remember, is in accord with the results of previous

examinations of the food-supplies of this State by competent men and with the position taken by this journal on the character of food-adulteration.

OUR BRITISH CORRESPONDENCE.

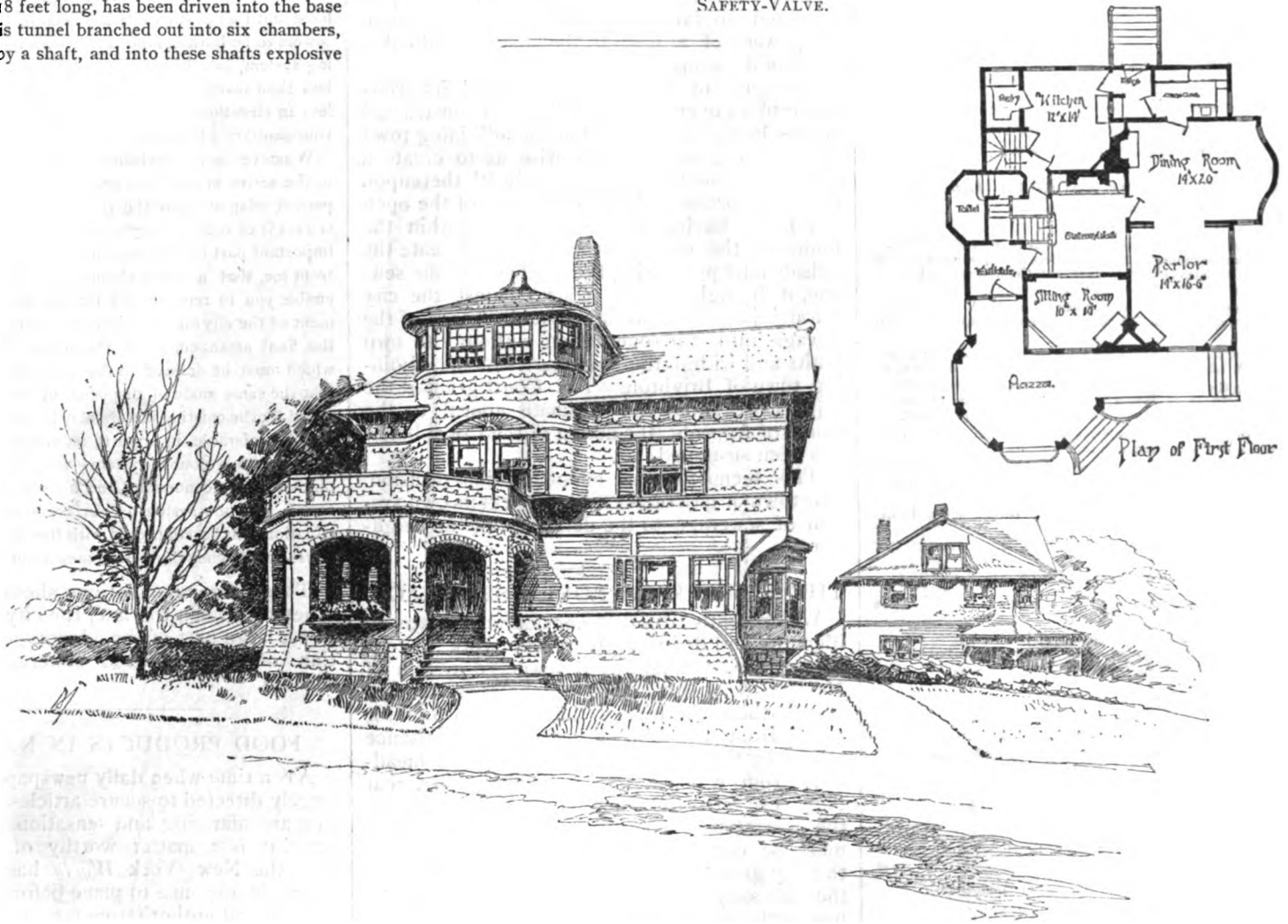
A Large Blast—Filthy Condition of River Logan—Ransome Paper on Timber Cutting in United States.

LONDON, May 25, 1887.

AN unusually big quarry-blast, stated to be the greatest piece of rock-blasting ever yet undertaken in England, was successfully accomplished on Saturday last at the Llanberis Quarries in the neighborhood of Snowdon. Between two workings of the quarry was a mass of rock endangering the lives of the men in the event of further excavations. This mass of rock was estimated at 100,000 tons, and the method of removal was as follows: Within the past two years a tunnel, 118 feet long, has been driven into the base of the rock. This tunnel branched out into six chambers, each terminated by a shaft, and into these shafts explosive

Mr. L. H. Ransome, Inst. C. E., has just read a paper before the institution on the "Conversion of Timber in the pine-growing districts of the United States by circular and band saws," giving therein conclusions arrived at from the study of the subject during a recent visit to the States. Summing up on the question of economy in results, he gives the palm to the band-saw, stating that with a 1-inch board the band will waste $\frac{1}{8}$ -inch per cut—that is to say, 120 per cent.—as against $\frac{1}{4}$ -inch by a circular saw, or 240 per cent. In a $\frac{3}{4}$ -inch board, planed, he states, it is necessary to allow only $\frac{1}{8}$ -inch on each side, as against $\frac{1}{4}$ -inch for the same work with the circular saw. He allows that at the present time the circular saw will show generally the best results, but points out that this fact is determined principally by the incomplete state of the works where band-saws are usually employed. These results, of course, are quoted on the most improved forms of band-saws.

SAFETY-VALVE.



A HOUSE AT LONGWOOD, MASS.—S. E. TOBEY, ARCHITECT.

gelatine was packed. Thirty-six hundredweight of gelatine, estimated as the equivalent of nineteen tons of powder, was used. The fuse to fire the charges was arranged for collective and instantaneous operation. Twenty minutes after firing the fuse there was an outburst of stones and earth, but very little report. The operation was perfectly satisfactory, the force of the gelatine being expended on the interior of the rock base, bringing the general mass down into the workings for removal.

I referred some months since to the state of the River Logan, which runs through the heart of Belfast, in the summer months, owing to the presence of sewage. At this period of the year, when the stream is stirred up by the screws of the steamers, there is undoubtedly a stench and nuisance. I see, however, that works have just been put in hand for the sewerage of the Ballynafeigh and Ravenhill districts of Belfast, and that it is intended to carry the sewage into the Logan. This sewage has formerly been run on to some marshy ground, but the fact that it is ponded there is no justification to diverting it into an already surcharged stream.

OUR SPECIAL ILLUSTRATION.

A MANTEL in the Tiffany House, New York, from designs by Mr. Louis C. Tiffany.

OUR VIGNETTE ILLUSTRATION.

THE subject of our vignette illustration this week is the residence of Mr. George Dexter at Longwood, Mass. The first story is clap-boarded and the second story, porch, and terrace shingled. Both the interior and exterior have been stained a variety of tints, the Dexter Brothers' stains being used for that purpose. The cost was \$7,600, and the architect was Mr. S. Edwin Tobey, of Boston.

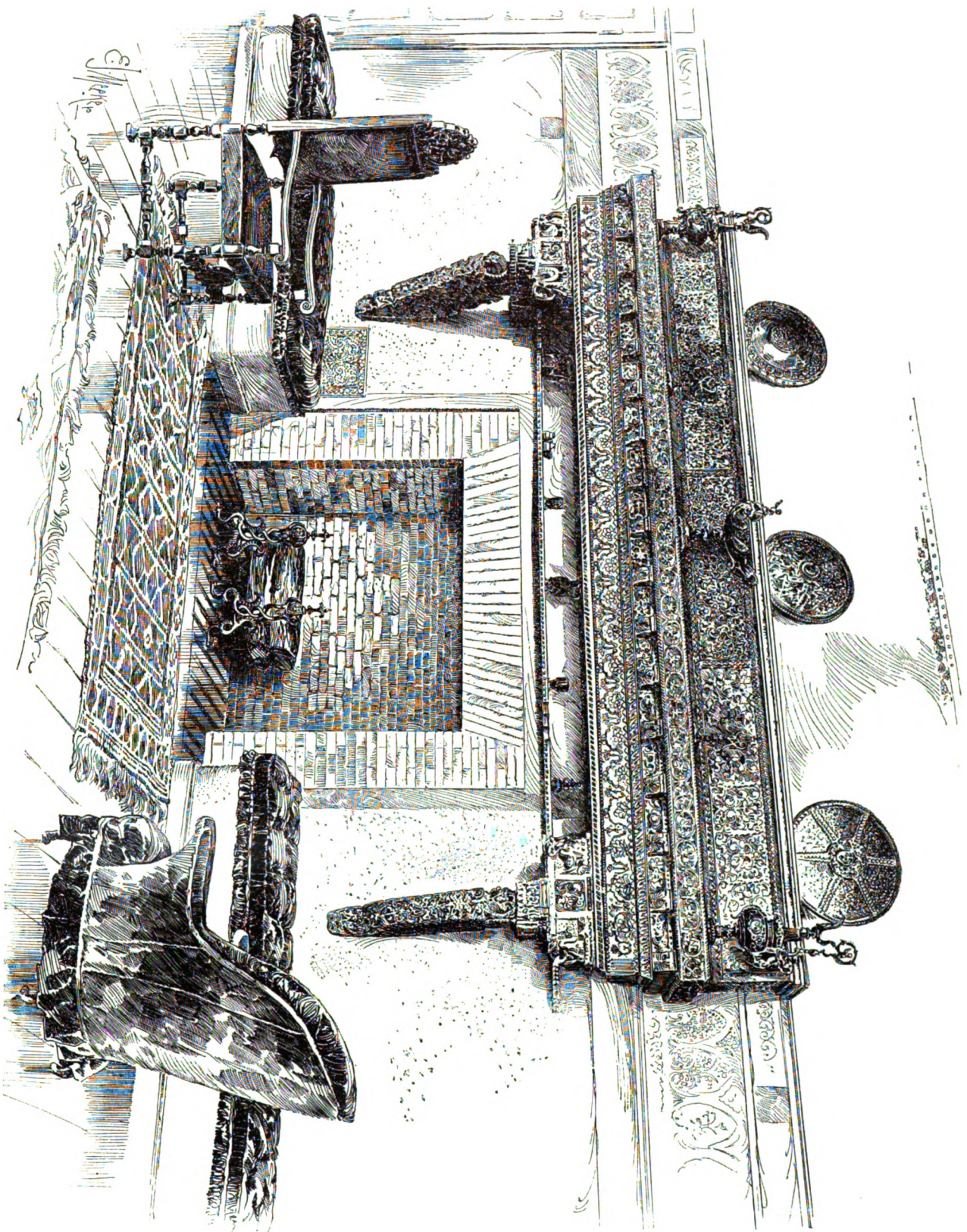
THE PRESERVATION OF WOOD.

PROFESSOR A. H. CHURCH, in a recent lecture on "Wood, Its Chemistry, Its Decay, and Its Preservation," thus alludes to the use of paraffine as a preservative of wood: "It was now believed that wood did not decay simply by the action of moisture and air, unless the germs of living beings were also present, and that was the reason

why the three classes of materials which prevented decay had been found to be effective. Some of these agents altogether excluded air and water, and were termed hydrofuge substances. A coating of excessively hard paraffine, melting at a temperature of 150° Fah., excluded all the germs of those minute organisms, and prevented decay. Paraffine was absolutely indestructible, and was unaffected by alterations of temperature or exposure, consequently it offered one of the best materials for the treatment of wood in cabinet or joinery work; and although it slightly increased the inflammability of the material for floors and parquetry, nothing was better than paraffine." He then mentioned substances which prevented the decay of timber which he termed of the poisonous class. "Air and moisture might be permitted to penetrate the wood, but by putting minute quantities of chloride of mercury, carbolic acid, acridine, cryptidine, or naphthaline into it, the timber

would show no alteration, except that the coloring matter was changed, until the preservative substance had escaped. Then there were substances which were non-poisonous, and not hydrofuges, but which yet prevented decay and paralyzed the organisms. A small quantity of the vapor of chloroform, and many other substances, were, without being actually poisonous, able for a time to prevent the decay of wood. On all grounds, therefore, they arrived at the conclusion that timber decayed on account of the presence of living organisms, and not by direct chemical action."

THE water-supply of the various European capital affords some interesting facts, not the least notable of which is that Rome heads the list with her 204,000,000 litres of pure water—a litre being a little more than one and three-fourths pints—every twenty-four hours, and, as her population is 345,036, every inhabitant can thus dispose of nearly 600 litres per day. London comes next, for every one of whose population of rising 4,000,000 there are 300 litres daily. Paris takes the third place, her population amounting to 2,240,124 and each inhabitant having for alimentary purposes 58 litres per day, and for secondary uses 169, or a total of 227. Berlin has 1,302,283 inhabitants, for each of whom there are 140 litres daily; Vienna, 770,172 inhabitants, with 100 litres each per day; Naples, 463,172, with 200 litres, and Turin, 278,598, with 90 litres a head every twenty-four hours.—N. Y. Sun.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A MANTEL IN THE TIFFANY HOUSE, NEW YORK.

DESIGNED BY LOUIS C. TIFFANY.



THE CHILDREN'S HOSPITAL, WALNUT HILLS, CINCINNATI.

THE Children's Hospital, as shown, is in reality two buildings, the administration block proper being in the front, and containing reception-room, day-room for the children, kitchen, general dining-rooms, officers' dining-room, sleeping apartments for the nurses, operating-room, etc.; the building in the rear being divided on each side of the central corridor into male and female wards. This was found necessary, as the children who are received and kept at this hospital range in age from that of mere infants to fifteen or sixteen years old, and the division into male and female wards was found necessary on that account.

In connection with the wards are private rooms for the most serious cases, also bath-rooms, linen-closets, water-closets, etc.; the water-closets in every case being put in semi-detached wings.

Attention is called to the fact that the wards or hospital building proper is separated from the administration block by an open corridor. These are so arranged that they can be enclosed with sash if thought necessary, but it is the intention of the managers at present to leave them entirely open, thus having free passage of air between the two buildings. At the same time the corridor is covered over and protected from the weather by a roof.

In the third story over the wards is placed a "suspect" ward or ward, for contagious diseases, this being kept entirely from the wards below and being only accessible from the third floor of the administration block.

The building is to be heated by steam, and the coils are placed under the windows in the wards and the stool of

the window is made to extend back and cover over the top of the coil. This gives a marble capping to each coil. Air is admitted to these coils through an opening under the sill and the draught is regulated by a valve worked from the inside. Above and below each bed is placed a wall register connected with a flue in the wall, this being carried up to roof-loft and conducted through tight metal pipes to the central cupola in the middle of the ward building, where a Blackman fan is placed to assure mechanical ventilation at all times. The speed of the fan will be regulated so as to remove air without creating any great draughts.

In the interior finish of the building the aim has been to keep everything as smooth and neat and clean as possible, so there will be no chance for lodgment of dirt, the walls being finished with cement wainscoting and all the angles rounded so as to have everything accessible. The jambs between the windows are plastered and no heavy wooden casings are used in any place.

The material of the building is dark red common brick laid up in the usual manner and trimmings of Ohio free-stone.

The roof is of slate. The walls of the ward portions are built hollow, but the walls of the administration block are built in the ordinary manner, being solid walls.

In connection with administration block is a day-room or convalescent-room for children, and connecting with this is a wide piazza where they may take out-door exercise.

The buildings are also surrounded by spacious grounds and finely-kept lawns, and being elevated high above the city and out of the way of the prevailing smoke wave, the children will be provided with plenty of fresh air and sunshine.

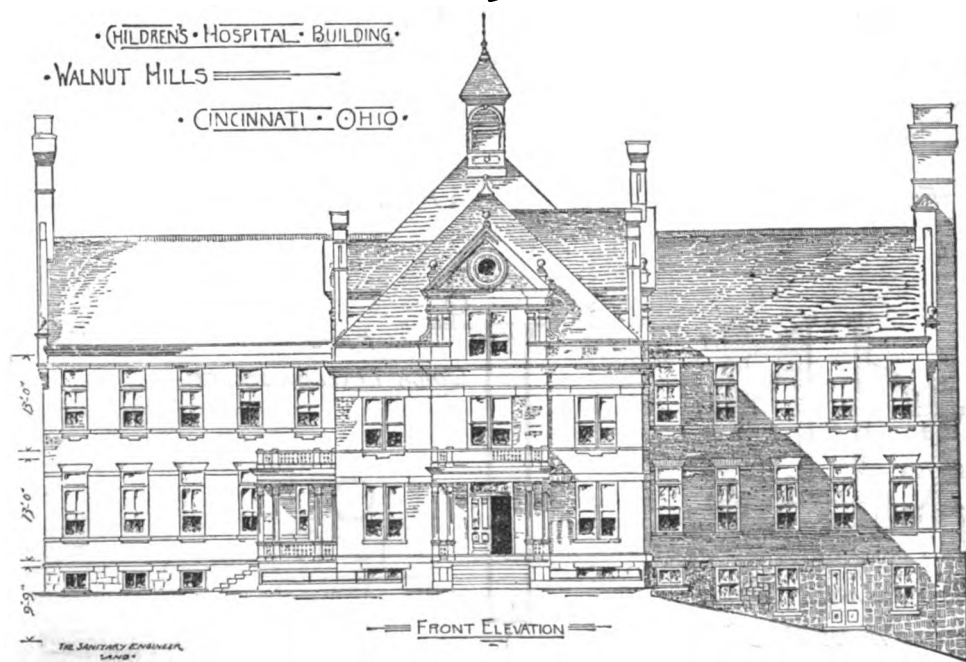
There is also a class of patients which will be treated by the physicians of this hospital, but which are not received within the walls of the hospital itself. These, known as out-door patients, are received and treated in the office in the basement of the administration block. The laundry will be in a separate building.

The architects are Samuel Hannaford & Sons, of Cincinnati.



— SIDE ELEVATION —

• CHILDREN'S HOSPITAL BUILDING •
• WALNUT HILLS •
• CINCINNATI • OHIO •



— FRONT ELEVATION —

THE NEW CROTON AQUEDUCT.

No. XIII.

(Continued from page 234, Vol. XV.)

DISK FOR MEASURING CROSS-SECTIONS IN TUNNELS.

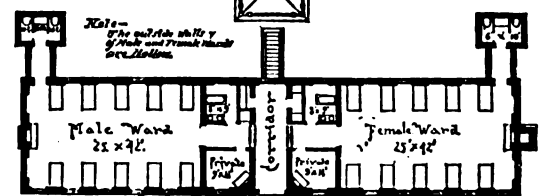
THE ordinary practice of measuring the sections of a tunnel is often slow and tedious, particularly so when it is necessary to repeat them every ten feet or less, in a tunnel having a large sectional area; but to reduce this labor to a minimum, the disk-measure was designed for the New Croton Aqueduct, where it is generally known as the "Sunflower." It is also useful for testing masonry work after centres are struck, to note if any settlement or distortion has taken place.

This instrument consists of a disk firmly secured to cross-pieces of wood, supported by braces *c*, which are riveted to tube *d*. This tube, when placed in position on tripod-head, can be moved vertically, and secured to any height desired by clamp-screw *A*. The disk *a*, and cross-pieces *b*, and "indicating-arm" *e*, are made of wood, but all other parts are brass.

Figure 1 is a vertical section through the "sunflower," *a* being the disk which is $\frac{1}{4}$ of an inch thick and 14 inches in diameter, firmly secured to cross-pieces *b*, which are $2\frac{1}{4}$ inches wide and $\frac{1}{4}$ of an inch in thickness. Figure 3 represents back of disk and frame, and to the latter a circular band, *g*, is fastened with screws. This band is $\frac{1}{4}$ of



SECOND FLOOR PLAN

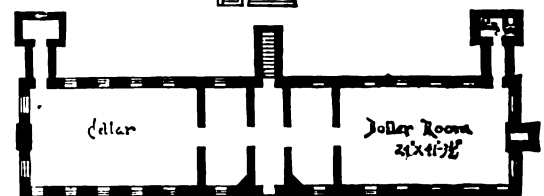


FIRST FLOOR PLAN

(CHILDREN'S HOSPITAL

WALNUT HILLS,

CINCINNATI, OHIO.



BASEMENT PLAN

an inch thick and $\frac{3}{4}$ of an inch wide. The vertical and horizontal braces *c*, in Figs. 1 and 4, are secured to this band at *i* in Fig. 3. The space between disk and vertical tube *d*, to which the braces are riveted, is $2\frac{5}{8}$ inches. This tube is $\frac{3}{4}$ of an inch in diameter and three feet long. The face of disk shown in Fig. 2 is graduated into degrees, from 0° to 180°. Bearing-plates are inserted on face and back of disk at axis shown by black lines at *k*, Fig. 4.

Figure 4 is a horizontal section on an enlarged scale of *a*, *b*, and braces *c*, with form of connecting latter with tube *d* at *h*. In Fig. 2 the dotted lines show relative position of "indicating-arm," which is represented on plan at *e*, Fig. 1, detached from section. At each end of this "arm" brass plates project to aid in guiding the rod used in measuring distance from axis of disk to perimeter of tunnel section. A vernier is marked on "indicating-arm" for reading distances less than half a tenth when desired for testing masonry work.

At axis of "indicating-arm" *r*, a solid piece of metal is firmly secured to "indicator," and extends through to back of disk, where it is held in position by spring *s* and a capstan-headed nut. This "indicator" is raised $\frac{1}{8}$ -inch from disk by a shoulder, permitting it to revolve freely. In Fig. 3, *s* is a plan of spring and capstan-headed nut. At *f*, Fig. 1, a longitudinal section of "sight-tube" is shown, which consists of a plain tube with a small hole at *f* in eye-piece, and vertical and horizontal cross-wires at *j*. Over this sighting-tube the leveling-bubbles are placed at *l*, and in plan on Fig. 6. Under the sighting-tube can be seen clamp-screw A, which is movable on the tube *d*. When sunflower is set in position this clamp rests on the tripod-head, and the disk can be raised or depressed to any desired height.

Clamp B is shown on the enlarged section of tripod-head, Fig. 5. The black lines at *m m* represent a detached piece of metal, which is in horizontal section about $\frac{1}{8}$ -inch less than a complete circle, thereby permitting clamp B to

secure the tube *d* in a firm position when the disk is set on centre axis of the tunnel in position for measuring sections. The ball and socket joint is also shown in Fig. 5.

Figure 6 is a section of a quick-leveling socket and a plan of the leveling bubbles.

This socket is a tube 5 inches long, closed at lower end except a small hole which is to allow a cord to be passed through to which a plumb-bob can be attached. Figure 7 is a plan of a protractor made expressly for this work. It is 3 inches in diameter, with a centre-piece of mica, from which an arm about 10 inches long projects, graduated to a scale of 20 feet to 1 inch, the same scale as section-sheet in Fig. 8 is made. The four black points on face of protractor indicate position of pins projecting from lower side, which are pressed into the paper when plotting, holding it firm in position. This arm revolves freely around centre-piece to any desired angle.

Two measuring-rods are furnished, made of pine, one being 8 feet and the other 14 feet long, 1 inch wide and $1\frac{3}{8}$ inches in depth, made tapering in depth only from centre to $\frac{1}{8}$ of an inch at one end to lessen weight, having a metal shoe on taper end to prevent injury when pressed against rock face of tunnel. The rods are divided in feet and tenths.

Directions for using Sunflower.

The centre line of tunnel is not preserved on the floor, where constant travel would disturb it, but by drilling holes in the roof about 50 feet apart. Into these holes pine plugs $1\frac{1}{2}$ inches in diameter and 4 inches long are driven; and into this plug a horse-shoe nail

with head flattened and having a centered eyelet is inserted. Through this eyelet telegraph wire is suspended from two plugs, and kept in position by weights of about 25 pounds each (a stone will do). A wire can then be stretched between these two points, which will produce a line close enough for rock sections. Over this horizontal wire a tripod which has extension legs, is set with disk detached. The tripod is then made plumb and leveled, by inserting quick-leveling socket shown in Fig. 6. When this operation is completed, the leveling-socket is removed, and tube *d* is placed in position in tripod head, and the disk raised to the required elevation by sighting through sight-tube to a leveling-rod held on bench, and then fixed firm in elevation by clamp-screw A.

The sight-tube is then turned in the direction of the vertical wire in advance of the instrument, which can be readily seen by use of a lamp for that purpose, and fixed

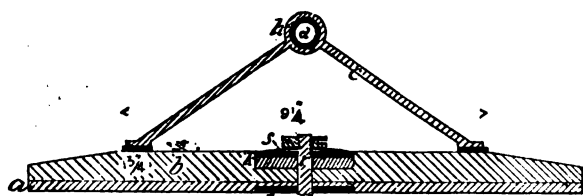


FIG. 4. SECTION THROUGH DISK & HORIZONTAL BRACES

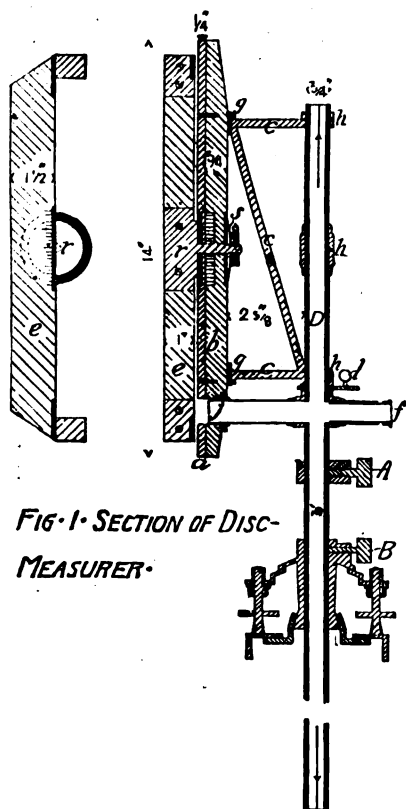


FIG. 1. SECTION OF DISK-MEASURER.

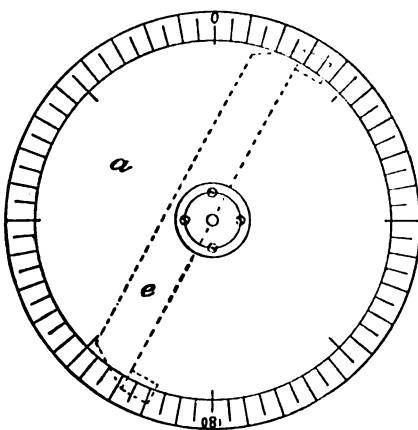


FIG. 2. FACE OF DISK.

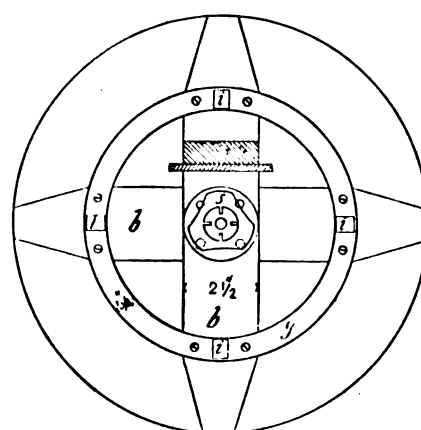


FIG. 3. BACK OF DISK.

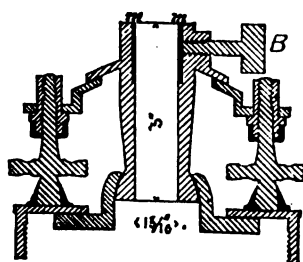


FIG. 5. ENLARGED SECTION THROUGH TRIPOD HEAD.

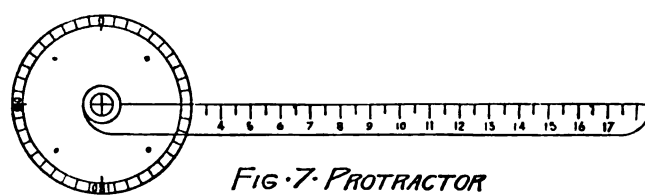


FIG. 7. PROTRACTOR

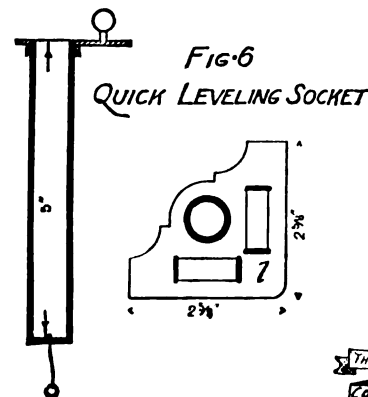


FIG. 6. QUICK LEVELING SOCKET

• INSTRUMENT •
FOR MEASURING CROSS SECTIONS
IN TUNNELS

THE SANITARY ENGINEER
and
CONSTRUCTION RECORD

in position by clamp-screw B. The disk will then be on centre line, and in position at right angles with central axis of tunnel. When more accuracy is desired, the line can be given with a transit. The sunflower is now ready for taking sections. The "indicating-arm" is set at 0°, and measuring-rod previously described, resting on indicator is extended to perimeter of section, and distance recorded; then indicator is moved to next angle; distance and angle recorded, this operation being repeated from 0° to 180°, when the rod is reversed and opposite half of section measured in same manner. A copy of a field record is shown in Table II., and plotting of the field notes illustrated in Fig. 8.

Table I. is the form used in field books for recording location of plugs driven in roof of tunnel for alignment. First column is station; second, number of plug; third, elevation; fourth, roof grade, which is twelve inches above intrado of arch; fifth and sixth columns, the height of plug above or below this grade; seventh, name of person setting plug; eighth, the date; ninth, distance from centered line.

Table I.

LIST OF PLUGS IN TUNNEL NORTH OF SHAFT NO. 29.

STATION.	No.	Elevation.	Roof grade.	Hgh.	Low.	Set by.	Date.	From line.	REMARKS.
1482+46.10	16	177.47	174.20	3.18	..	C.T.F.	1885. June 3	..	..
1481+85.74	17	185.38	183.37	2.01	..	"	"	..	..
1481+31.75	18	192.42	191.46	0.96	..	"	"	..	Centre of shaft
1480+98.74	19	198.397	196.41	1.99	..	M.C.	"	..	..
1480+55.00	20	205.77	202.97	2.81	..	C.T.F.	"	..	Inside of shaft.
1479+87.48	21	213.30	213.10	0.20	..	H.C.	"	..	..
1479+49.48	22	218.282	217.48	0.80	..	M.C.	Au. 13	..	Screw blownout

Table II. represents a record of notes taken for rock excavation measured at two sections in the tunnel, with date and station of cross-section. The first and second columns, give angle and distance from centre of disk to perimeter of cross-section on east side; the second and third columns, a similar record for the west half of cross-section. Left and right, can be used in place of east and west, to designate division of cross-section; but the latter is preferred, as it eliminates any doubt of the direction a field party may have been working when taking the cross-sections, as the axis of the tunnel extends in a northerly and southerly direction. The note below table, "Axis 2.2 below spring," indicates elevation of the centre of disk when the cross-sections were taken. The area of cross-section can be correctly measured, by setting the sunflower at any point within the plane of the cross-section. Some engineers prefer to set centre of disk at a uniform elevation above or below spring-line to give uniformity of working-line, as ordinates can be calculated, giving distance to perimeter of section, a reference to which at time of taking cross-section will determine if excavation has conformed to the section required.

Table II.

NOVEMBER 18, 1886.				DECEMBER 27, 1886.			
STATION 1483+20.				STATION 1482+20.			
EAST.		WEST.		EAST.		WEST.	
Deg.	Dist.	Deg.	Dist.	Deg.	Dist.	Deg.	Dist.
0	9.7	15	10.2	20	13.0	0	14.8
15	9.9	32	10.7	34	12.7	18	11.6
36	10.5	47	10.3	50	10.4	36	11.8
53	9.5	60	9.0	70	10.1	51	10.8
70	8.1	79	7.5	86	9.1	68	9.6
85	7.1	105	6.7	99	8.2	82	8.5
105	7.0	123	6.7	117	7.9	90	8.3
129	6.3	145	5.7	146	6.7	110	7.4
150	5.4	165	5.0	..	..	135	6.4
180	4.9	..	..	..	..	150	5.2
..	..	..	..	..	..	180	4.8

Axis 2.2 below spring of arch.

Axis 2.4 below spring of arch.

Figures 8 and 9 represent the notes recorded in Table II., plotted to facilitate a correct computation of the areas. The form of printed sheets used for that purpose is given in Fig. 8, with angle of each measurement computed from the notes given in Table II. All sheets for this purpose are printed on a scale of 20 feet to one inch, the same scale as the arm of the protractor used for plotting, which has been previously described. The axis from spring-line is first marked on a sheet, then centre of protractor put in position over it, and pressed firmly down, which will project the pins through the paper and keep it in position, permitting arm which revolves around centre to be moved

quickly to any point desired for plotting notes of cross-sections.

In Table III. the field notes plotted on Fig. 8 are arranged for computing, the number of shaft, heading station, and date of measurement being recorded. It is separated in two divisions, one for the east and the other for the west half of the section. The first column contains the numbers which designate angle taken, and second the factors required to compute the area of a triangle, which are the length of two sides and the included angle; the third column logarithm of the factors, and fourth, the area. The westerly half is calculated in a similar manner; the amount of the two added together, and divided by 2, will give area of whole section. To diminish the labor of taking off the logarithms, two tables are prepared on separate sheets, one containing copy of the logarithms of numbers from 1 to 20.9 advancing by tenths, and the other logarithmic sines from one to sixty degrees advancing by single degrees. *The sheets in size are 8x10 inches. The sheet to contain logarithm of numbers is divided into twelve columns, the ten intermediate columns being headed by the numerals 1 to 10, the first and last containing decimals 1 to 10, and ten columns between containing the logarithms. The sheet is separated into two parts, permitting the logarithms from 11 to 20 to be entered on the lower half.

Table III.

SHAFT NO. 29—HEADING STATION 1483+20. DATE OF MEASUREMENT, NOVEMBER 18, 1886.

EAST SIDE.				WEST SIDE.			
Δ	Factors.	Log.	Double Area.	Δ	Factors.	Log.	Double Area.
1	9.7 15° 9.9	0.98677 9.41300 0.99564	24.854	1	9.7 15° 10.2	0.98677 9.41300 1.00860	25.607
2	9.9 21° 10.5	0.99564 9.55433 1.02119	37.252	2	10.2 17° 10.7	1.00860 9.46594 1.02938	31.901
3	10.5 17° 9.4	1.02119 9.46594 0.97772	29.161	3	10.7 15° 10.3	1.02638 9.41300 1.01284	28.524
4	9.5 17° 8.1	0.97772 9.46594 0.90849	22.498	4	10.3 13° 9.	1.01284 9.35209 0.95424	20.852
5	8.1 13° 7.1	0.90849 9.35209 0.85126	12.937	5	9.0 19° 7.5	0.95424 9.51264 0.87506	21.976
6	7.1 20° 7.0	0.85126 9.54505 0.84510	16.998	6	7.5 26° 6.7	0.87506 0.64184 0.82608	22.028
7	7.0 24° 6.3	0.84510 9.60031 0.79934	17.937	7	6.7 18° 6.7	0.82608 9.48098 0.82608	13.868
8	6.3 21° 5.4	0.79934 9.55433 0.73239	12.191	8	6.7 22° 5.7	0.82608 9.57158 0.75588	14.306
9	5.4 30° 4.9	0.73239 9.60897 0.69020	13.230	9	5.7 20° 5.	0.75588 9.53405 0.69897	9.747
		1.12156	13.230			0.98890	6.340
			187.058			0.69897	195.149
			195.149			0.80217	6.340
			2)382.207				
			Total Area, 191.103				

On the other sheet is copied the logarithmic sines from one to sixty degrees. This is divided into eight columns, with angle and sine placed in alternate columns. If the field notes are carefully plotted on the section sheets, the area can be computed quickly with a planimeter, and the variation from the correct area will be less than two-tenths for the whole section. The time required to measure a section of the tunnel with the "sunflower" is from six to ten minutes. It was designed by Alfred Craven, a division engineer on the aqueduct. The weight of the disk, including all attachments, is ten pounds, and the tripod-head, with tripod, having extension legs, 10 1/4 pounds, making a total weight of 20 1/4 pounds. It is manufactured by Heller & Brightly, of Philadelphia, for \$69.50, which includes the two measuring-rods. The protractor is made in New York by Guardam & Sons.

THE COMPARATIVE VALUE OF STEAM AND HOT WATER FOR TRANSMITTING HEAT AND POWER.*

THE relative value of steam, water, or other vehicle for the purpose of distributing heat to be used for heating and power purposes, curiously involves, in a large degree, the same elements as the transportation of passengers and freight on railroads. With the latter, the relative amount of paying and non-paying load forms one of the most important considerations, while with the former the relative values depend largely upon the percentages of their heat-carrying capacities which can be utilized in practice. In generating steam with fuel, the gases may be reduced in temperature nearly to that of the steam itself, securing fair efficiency, but in melting metals, they must be rejected at a temperature higher than that of the metal, and economy secured by secondary operations to save waste heat. Similarly the efficiency of the heat transmitting medium depends upon the amount of heat rejected or unavailable by the conditions of the problem compared with that originally imparted to such medium.

If steam and hot water of 400 degrees temperature be respectively used for some heating purpose, such as cooking, requiring nearly that temperature, the steam will give up its latent heat and be converted into a small quantity of water at the final temperature, while hot water can only give up its sensible heat represented practically by the difference between its original and final temperature. If the fall of temperature be from 400 to 399 degrees, the water would impart substantially one thermal unit for each pound of water circulated over the surface, while the steam would impart over 800 thermal units for each pound of water condensed. If a difference of 2 degrees were allowed, the water would impart substantially two thermal units for each pound of water circulated, whereas the heat supplied by the condensation of one pound of steam with same limits of temperature would be but slightly reduced, though the relative quantity of water required to be circulated to equal the results obtained with one pound of steam would be reduced one-half. By allowing a still greater reduction of temperature the water would appear at less disadvantage. For instance, with a difference of temperature of about 11.15 degrees the water would impart 11 1/2 thermal units for each pound of water circulated and the steam 842 thermal units for each pound condensed.† This is doubtless a greater reduction of temperature than could be allowed for cooking, and yet it would require (842.04 ÷ 11.52 =) 72.71 times as much water circulated to do the same work as would be required if steam were used. In this case, then, 72.71 pounds of water would necessarily be heated at the station, pumped to the point where the heat was required and then be forced back again to the station at a lower pressure and pumped into the boiler to be reheated, for each pound of water evaporated if steam were used as the medium of transmission. The steam would be transmitted by causing a slight difference of pressure from the heating station to the point where it was used, and its surplus pressure would return the water of condensation back to the station, where one pound would require to be pumped in the boiler for each 72.71 pounds by the water system.

As the temperature at which the heat is to be applied is reduced, the preponderance against the water system somewhat diminishes. For instance, if steam at 70 pounds pressure be required to operate engines, it may be obtained by directly expanding down the steam of 235 pounds pressure, which would result in a beneficial superheating of 25.87 thermal units per pound of steam thus expanded. If, however, the steam were supplied from hot water at 400.89 degrees temperature, corresponding to the pressure of 235 pounds, only 10.2 parts in 100 would, on reducing the pressure to 70 pounds, flash into steam at that pressure, so in that case 10.2 pounds of water would necessarily be heated at the central station, transmitted to the point where steam is required, and if high-pressure engines were used, 9.1 pounds would necessarily be transmitted back again, and finally 10.1 pounds pumped in the boiler for each pound weight of steam used, instead of the one pound which would be required to be evaporated at the central station in the case of the steam plant.‡

For heating purposes, the temperature could, under favorable circumstances, be reduced to 228 degrees in the coils, corresponding to a pressure of five pounds, in which case, without repeating the operations above described, there would require to be circulated from the heating station to the point of supply and back to such station, 5.69 pounds of water for each pound of steam utilized at the point of supply, or for the heat which would be imparted

* Paper read at meeting of American Society of Mechanical Engineers, at Washington, meeting June, 1887, by Charles E. Emery, of New York City.

† (A) Temperature due to 235 lbs. gauge or 200 lbs. absolute pressure, 400.89; temperature due to 205 lbs. gauge or 200 lbs. absolute, 389.74—difference, 11.15°. Total heat above 32° in the two cases, respectively, 373.75 and 362.17—difference, 11.5 thermal or heat-units. Total heat steam of 235 lbs. gauge pressure, 1,204.21 heat-units. Subtract 362.17 heat-units due to final temperature, gives 842.04 heat-units available from condensation of steam between limits of temperature stated.

‡ (B) Total heat steam of 70 lbs. gauge or 85 absolute pressure, 1,178.34 heat-units, which subtracted from 1,204.21 heat-units due to 235 lbs., foot-note (A), shows 25.87 heat-units for superheating. Temperature due to 70 lbs. gauge 316.08, corresponding to 286.26 heat-units above 32°, which subtracted from 373.75 heat-units due to 235 lbs. (A) leaves 87.49 heat-units available for making steam with water, and subtracting same from 1,178.34 heat-units, total heat due to 70 lbs., gives 892.08 heat units required for steam of 70 lbs. Hence there will be required 892.08 ÷ 87.49 = 10.2 pounds of water circulated per pound of water evaporated into steam of 70 lbs. pressure.

at the temperature corresponding to such pressure, for each pound of steam which in a steam system would be evaporated and sent direct from the station.*

The above statements may be easily verified from the figures given in the foot notes, and the great resistances found in pumping water through pipes at high velocities being well known, there would seem to be no reason why any one should think of using water rather than steam for the purposes above referred to. The subject, has, however, been agitated for a number of years. Little plants to show what could be done with water heated to a high temperature have been built from time to time, but apparently did not command the capital necessary to start the business on a large scale. Another revival has recently been attempted, however, based chiefly on the favorable report of an unusually well-informed engineer of experience and acknowledged ability, to whom it is a pleasure to say the writer is personally indebted for many valuable suggestions as to proper courses of study at an earlier period of life. Mr. Isherwood, in forming his opinions, has evidently, however, failed to consider some of the most important elements of the problem, and occasion is thereby made for an abstract discussion on the merits of steam and hot water, so far as possible, without reference to the merits of a particular system and the details of the same.

It has been stated in the public press, quoting from the report, that a cubic foot of water at 400 degrees temperature contains $34\frac{1}{2}$ times as much heat as is contained in a cubic foot of steam at the same temperature, and it is therefore concluded that "the areas of the pipes will be in this proportion, making their diameters in the proportion of 1 for the water and $(\sqrt{34\frac{1}{2}}) = 5.89$ for the steam." Also that "the thickness of the material of the pipes for equal strength would have to be about six times greater for the larger steam-pipe than for the smaller water-pipe, even if both were lap-welded." On the supposition that larger steam-pipes would be necessary, comparisons were presented of the "greater bulk," "enormously greater cost," "extra loss of heat by conduction and radiation" due to the larger pipes, with some further remarks about the difficulty of getting rid of the water of condensation in steam-pipes, difficulties of management, etc., not at all warranted by the state of the art in relation to steam plants. Evidently the error behind these statements is to be found in the assumption that because a given quantity of water of the temperature assumed contains $34\frac{1}{2}$ times as much heat as that of an equal volume of steam, therefore the steam-pipe must be proportionally larger to that extent. It ignores entirely well-known laws of hydraulics, which teach that a fluid of much less density than another will, with the same difference of pressure, flow at a much higher velocity. The weight of a fluid transmitted through pipes with comparatively small distances of pressure at opposite ends, is proportioned to the square root of the 5th power of the diameter of the pipe, into the square root of the pressure gradient (represented by the difference of pressure between the two points divided by the length) into the square root of the weight per unit of volume of the fluid, for instance, the weight per cubic foot, called by Weisbach the "heaviness" and herein designated the "specific weight." Therefore, for the same loss of pressure in the same distance and the same size of pipe, the relative weights of water transmitted would vary as the square roots of the specific weights. The weight of a cubic foot of water at 400 degrees is approximately 53 pounds, and a cubic foot of steam at the pressure of 235 pounds due to such temperature is 0.5478 pounds. The relative weights of the steam and water are therefore as 1 to 96.36. The weights transmitted under like conditions as above referred to, would therefore be as the square roots of these numbers, or as 1 to 9.816. Therefore, if the steam and water be compared on the basis of use for heating buildings exclusively, which, as has been shown, is most advantageous to the water system, there would, as has been stated, be required a circulation of 5.694 times as many pounds of hot water as of steam, but 9.816 pounds of water would, under like conditions, be circulated to 1 of steam. The relative capacities of the pipes required to convey the steam and water under like conditions would then be for the steam 1, and for the water, the increased weight required—viz., 5.694 divided by the increased weight conveyed—viz., 9.816, or as 1 to 0.5796, or as 1.7253 to 1. But the carrying capacities of the pipes are not as the areas or the squares of the diameters, but on account of the friction element, as the square root of the fifth power of the diameters, on which basis, under this most favorable condition for the water-pipe, the diameter of the steam-pipe would require to be but 24.38 per cent. in excess of that of the water-pipe. This does not, however, represent the relative cost of the system. For heat taken the same distance, the return pipe of the water system must be as large as the direct pipe, whereas that of the steam system, which has to do but about one-sixth of the work, could, on merely theoretical conditions, have a carrying capacity that much smaller. For practical reasons which, as will be shown hereafter, will have greater force with the water system, this pipe is made somewhat larger, or on the average about one-half of the diameter of the steam-pipe. On the basis that the costs are proportioned to the lengths and diameters, which is not far from correct when the two pipes are laid together in the same trench, the cost of the steam-pipe of 1.2438 diameter should be increased one-half

to allow for the return pipe, making in the case of the steam system 1.8657 compared with 2 as the cost of the full-size double pipes of the water system, which numbers are as 1 to 1.072. That is, even under the most favorable conditions for the water-pipes, they would cost at least 7 per cent. more than the steam-pipe system, and even this result is obtained by favoring the water system in the calculations, for the reason that the water has to be pumped double the distance that the steam is conveyed, and therefore requires double the difference of the pressure. However, as this pressure is produced with a pump, for simplicity the comparison has been allowed to stand as above.

If the water-pipes were designed to furnish power at a distance by generating steam to be used at 70 pounds pressure, it would be necessary, as stated, to circulate 10.2 times as much water as would require to be evaporated for steam used directly, when, on the same basis previously discussed, the water-pipes would require to have 3.9 per cent. greater carrying capacity under like conditions than the steam-pipe—that is, would require to be of 1.55 per cent. greater diameter, when the cost of both the direct and return water-pipes would be 35.4 per cent. greater than that of the steam-pipe and its smaller return-pipe.

If, however, the water-plant were designed to furnish water for cooking purposes, and the temperature were maintained in the stoves at 400 degrees by circulating, as claimed, water of only 400 degrees, there would be required the circulation of an infinite quantity of water to fulfill this condition. If, however, the temperature in the stoves were allowed to fall one degree below that of the water there would require to be circulated, as first stated, something over 600 times as much water as would be required to be evaporated and conveyed if the work were done by steam. Without stopping to calculate the size of the enormous pipe required on this basis, we may assume, as before, that in practical work a loss of say 11.15 degrees would be permitted. On this basis, as stated, the water required to be circulated would be 72.21 times the weight of steam required to do the work, so the water-pipe would necessarily have 7.407 times the carrying capacity of the steam-pipe, or 2.228 times the diameter, and the cost of the two systems of piping on the basis above explained would be as 1 for the steam to 2.97 for the water. We thus see that in doing exclusively the work for which these high-pressures are principally to be carried—to wit, cooking—instead of the steam-pipes requiring to be 46½ times the area, or 5.8 times the diameter of the water-pipe as claimed, the water-pipes must have 7½ times the carrying capacity, be of about 2¼ times the diameter, and about 3 times the cost of the steam-pipes. The relative cost of the pipes by no means represents the cost of operating the two systems. The water system would always be at a disadvantage in this respect on account of the high cost of pumping.

It should be stated that it is proposed to use steam for power at only 20 pounds pressure, but it is unnecessary to say that this would involve a very extravagant use of steam, and the size of the pipes would only take an intermediate position between those given for heating and power, respectively. It may also be claimed that the fall of pressure available to transmit steam is limited, whereas the pressure available by pumping to force the water is comparatively unlimited. This will not sustain investigation. With an initial steam-pressure of 80 pounds a loss of pressure of but ten pounds will give, in a steam-pipe 12 inches in diameter and one-half mile long, a velocity of fully 80 feet per second, so that there will be readily transmitted, through such pipe, nearly 1,700 horse-power of 30 pounds of feed water per hour for that entire distance. The most unfavorable conditions for the transmission of steam are when used for cooking where a high temperature is to be maintained; but even in this case, unless the assumption be made that the water will maintain the ovens at 400 degrees with steam at 400 degrees temperature, which, as has been stated, will require an infinite quantity of water circulated, there must be some loss of temperature, and as soon as it is permitted to drop, so that instead of fabulous quantities only 72 times as many pounds of water is required to be circulated as of steam, the loss of temperature of about 11 degrees entails a loss of pressure of 30 pounds, and but a portion of this difference of pressure will circulate the steam as fast as would be safe for the permanence of the pipes. With water the velocity would need to be kept down in the inverse proportion of its density compared with that of steam, for a similar reason. If the necessary loss of temperature for cooking be made up by increasing the temperature of the water, this would also, in a much greater ratio, increase the pressure of the steam and still keep it at an advantage.

An average presentation of this branch of the subject may be had by examining the pressure available when the hot-water and steam are used to furnish steam for power. In the case of the hot-water, in order to evaporate about ten per cent. of its volume into steam, the reduction in temperature will be that due to a fall in pressure of 165 pounds, or from 235 down to 70 pounds. In a steam system this entire difference of pressure may be used as the energy which transports the steam to the point where it is used, and as the pumping pressure on the principles above expressed must be double this, the circulating pump would require to work against a pressure of 330 pounds to compete with steam, and 0.2 times as much water must be pumped with the water-plant as would be required by the steam-plant; also the water for the water-plant must be pumped twice—once at the high-pressure of 330 pounds to circulate it in the pipes, and again at 235 pounds to pump it into the boiler; whereas, with the steam-plant one-tenth of the quantity of steam would be pumped and but once—viz., into the boiler—how,

ever, be claimed that the steam-plant must be charged with the power required to return the water of condensation. The water is returned in practice by the pressure in the heating systems or by steam operating pumps, or pump-traps which exhaust into the heating systems, so that no heat is wasted, and the losses are too inconsiderable to mention in comparison with the handicaps of the water system.

The hot water circulated has been called "superheated water," because it is hotter than 212°, but, of course, water cannot be superheated in the scientific sense that its temperature exceeds that due to its pressure. Steam may be superheated and must always have as high a temperature as that due to its pressure. Water cannot be superheated, but may, of course, have a pressure greater than is due to its temperature; in other words, be *sub*-heated, which is the condition that the so-called superheated water would be in when maintained at constant pressure the moment it imparted any heat to another object.

Reference must finally be had to one point, which has been made to appear very important on paper. The following quotation may be made:

"The fuel cost of the power developed by the steam-engines employed in [a hot-water] system for circulating the superheated water in the hot-water pipe, for pumping the used water from the return pipe into the boiler, for driving the blowers, if a mechanical supply of air is needed for the combustion of the coal, and for hoisting coal and its refuse, will, owing to the peculiarity of the system, be not over one-twelfth of the similar cost per horse-power developed by the most economical steam-engines employed in other work. In fact, the only coal required to work these circulating, pumping, blowing, and hoisting steam-engines, is what furnishes the heat actually transformed into work according to the thermodynamical theory, and to supply the loss of heat by conduction and radiation from the external surfaces of these engines. The cooled water from the return-pipe will be in such excessive quantity compared with the feed-water required for generating the steam used in the engines, that it will be enormously more than sufficient to condense all the steam worked through the engines, the condensed steam and the water condensing it will be wholly pumped back into the boiler, and there will be no rejected heat as in the case of other steam-engines, which rejected heat averages about eleven-twelfths of the total heat of the vaporization of water. If the cost of the indicated horse-power in the best engines be taken at about 2½ pounds of ordinary coal per hour, that cost, with the engines of a [hot-water] system, will be only one-tenth of a pound of coal per hour. The steam taken from the boilers at a temperature of 400° Fah. (pressure 250 pounds per square inch above zero) for working the engines, will be condensed by the water of the return-pipe at the temperature of, say, 160° Fah., and both the water of condensation and the condensing water will be pumped into the boiler, so that the total quantity of water in the boiler and in the hot-water pipe and in the return-water pipe will always remain constant."

With all the hot water used for power purposes rejected at a temperature of 316° and that for cooking at 390° or upward, how is the very large quantity of heat still remaining in the water to be reduced to the temperature of 160°, as stated in the above extract? It may be said it will be used for heating water, boiling articles of food, heating buildings, and such like uses. But what can be done with it in summer when there is no heating to do; but even in winter, or at any other time, in fact, how is the surplus heat in the hot water from cooking and power apparatus to be exactly that required for some other culinary operation or for heating some particular building? The slightest calculation will show that the surplus heat will be so great that it cannot in practice be reduced to the temperature stated. The low temperature of the return water could only be secured in individual instances in buildings provided with specially large heating coils arranged to receive the water as it was about to escape to the street. Houses and public buildings already provided with heating apparatus would necessarily have connections made to the apparatus in place, and the heat would be rejected at the temperature of the steam used for heating, say at the temperature due to five pounds, as has been provided for in the previous calculation. In no case, as has been intimated, could it be assured that the surplus heat from the cooking apparatus would not exceed that required for other culinary operations and heating the house. In seasons when no heat was required the only economical way to dispose of the hot water at 390° rejected from the cooking apparatus would be to pump it back to the station at that temperature and at the temperature due thereto. The result would only be worse were it allowed to expand down to atmospheric pressure, for then a large portion would fly into steam and the return-pipes be filled with a mixture of steam and water. If the hot water were used to generate steam for power the surplus heat would be so great that it would be impracticable to dispose of it in the same or adjacent buildings even during the heating season. Few factories can use all the exhaust steam from their engines, whereas with the water system there would be about five times as much heat in the rejected water as would be used in the engine. If part of the latter be used for heating, the heat in the exhaust steam must be absolutely wasted. In fact, at all times a very large quantity of hot water must be rejected at the temperature of 316° due to the pressure, and as in the case of cooking the only economical way would be to return it to the station at a pressure of 70 lbs. If it were permitted to expand down to the pressure of the atmosphere, there would be 2.89 cubic feet of steam per pound of water circulated, or 29.4 cubic feet of

* (C) Temperature due to 5 lbs. 227.96°, equivalent to 196.66 heat-units above 32, which latter subtracted from 373.75 heat-units in water due to 235 lbs. pressure, gives 177.09 heat-units per pound of water, and subtracted from 1,204.21, total heat due to 235 lbs. pressure, gives 1,027.12 heat-units available from steam between same limits, so that there will be required $(1,204.21 \div 177.09) = 6.80$ times as much water circulated as steam.

steam at atmospheric pressure in the returns for each pound of water evaporated into steam for use in the engines, and the volume of steam in the return-pipes would be about 60 times as large as the water contained in the same. Of course, in a small plant for exhibition purposes, radiators may be arranged to keep down the temperature rejected from cooking and power systems, but a slight study of the problem will, as above indicated, show that the demands for different purposes cannot be adjusted, even in winter, so as to prevent the rejection of a great deal of heat, and that in summer the heat in the water can practically only be utilized through a small range of the higher temperatures, and much the greater part of the heat must be rejected, though it may be returned to the station at great cost and be saved if practical means are found for the purpose.

The writer has thus far discussed the subject in the abstract without comparison with other work. At this point it may be of interest to state that precisely the feed-water apparatus described above has been used from the first in the plant of the New York Steam Company designed by the writer, and that we are barely able to condense the steam which comes back in the returns *when half the feed-water is supplied directly from the Croton mains* to make up for the loss due to the escape-steam from high-pressure engines supplied on the lines. At times a portion of the steam from the pumping-engines can also be condensed in the tank, but at others a portion of this escapes. It is utterly hopeless to do better or even as well with a very much larger proportion of hot water supplied from the returns.

If the present proposed system, to return the water at high-pressure, be changed, then, without helping the feed-water question, all the old complications of the former developments of the system will be necessary in every house, and under some circumstances boilers would necessarily be used on the premises arranged to be heated by hot water instead of fuel. On the other hand, if steam be used merely the full range of temperature is available for every operation, and the heat rejected due to the smaller quantity of water required be readily returned to the station by the surplus pressure in the pipes.

It will naturally be asked what the probable cost of pumping the hot water will be. This requires the assumption of a certain set of conditions. Previous discussion has been based on allowing the hot water a difference of pressure at the two ends of the line of twice that allowed to the steam between the station and the point of use. On this basis, with a comparatively low-pumping pressure, say a difference of twenty pounds between the extremes of the line, the net power required for pumping would be somewhat more than one per cent. for each volume of water pumped compared with that required to be pumped in the boiler for a steam system. Reckoning the efficiency of steam-pumps at 50 per cent. on the basis of one horse-power for the heat required to evaporate 30 pounds of water from 70 pounds pressure per horse-power, there would be required for circulating water for heating fully 11.4 per cent. of the power transmitted through the pipes; for power there would be required fully 20.4 per cent., and for cooking fully 145.4 per cent. Higher pumping-pressures would of course entail higher losses. For the steam plant, on the contrary, there would be required on the same basis for pumping the water in the boiler, a little less than two per cent. of the power transmitted, and this cost would be independent of the loss of pressure in transmission. The water in the returns would be forced back, as has been stated, by surplus pressure. It will be seen therefore that the water plant will not only be more expensive to construct originally, as well as more difficult to operate, but that the actual cost of the operation would be greater in the proportions stated, independent of many other considerations which cannot here be discussed, which would make the cost still greater on account of the indirect method of doing the work.

The resistance to explosion of the steam and of the water-pipes could be made the same originally by increasing the thickness of the water-pipes proportionally to their increased diameters; but if high capacities were attempted by pumping water at very high velocities the pipes would be rapidly scoured out so as in time to become dangerously thin. In case of a break in the steam-pipe the steam dissipates at once and is not dangerous. The writer has known a case where, through carelessness of workmen, a man was struck full in the body at a distance of only a few feet by a jet of steam two inches in diameter issuing from a pipe at eighty pounds pressure, but no injury to his person whatever resulted. Evidently, however, a single quart of hot water, projected in the same way, would have caused fearful scalds, and anything like the same quantity of water as of steam would have caused a lingering death. Hot water is also very destructive when the pressure is suddenly released, and the flying particles would scald persons and do other injuries, even when projected long distances.

It is interesting to see all the operations of cooking performed by hot water of high temperature, but evidently every one of these operations could be performed equally well by steam with the pressure due to such temperature, and all the operations would be much more simple and economical. In other words, the advantages due simply to high pressure are claimed for hot water. It may be said that the hot water at the high temperature ought to be compared with steam at the pressures ordinarily carried, but the steam can be supplied at the high pressure much more readily than the water. There is, however, a separate question as to the relative advantage of transmitting steam, at the high pressure of 235 pounds referred to above, compared with a transmission at a pressure

of 80 or 90 pounds corresponding to that ordinarily used in practice. Evidently the lower pressure will supply all the steam which is required for heat and power purposes quite as well as if generated at the very high pressure. The only possible object in increasing the pressure would be to do some kinds of cooking which cannot be done with the lower pressure, and it may be claimed to save something in the size of pipes. So far as the latter is concerned, the increased thickness must also be taken into consideration. The culinary operations which require the greatest amount of heat are the heating of water and the boiling of meat and vegetables. This can be done with perfect satisfaction with a steam-pressure but little above the atmosphere, say at the ordinary heating pressure of 5 pounds or under. Meat may be roasted and browned satisfactorily if put in steam-jacketed vessels directly on the metal with a steam-pressure of 40 pounds. This is done every day in many saloons. Of course, steaks and chops can be cooked in the same way if desired, though without the aroma of slightly scorched meat as in broiling. Cake and bread can be cooked, but not browned, with a steam pressure of 80 pounds. The higher pressure of 235 pounds is only required for such operations as broiling meat, and for the baking and satisfactory browning of bread and cake. But little bread is baked in private houses, and that required may be sent either to the bakers or be done in the house by customary methods on a particular day of the week. The other operations stated as requiring a high temperature can readily be performed at very slight expenses with gas-stoves. When the comparatively small income to be derived from this particular work is considered in connection with the enormous cost required to do such work, particularly with hot water and also to some extent with steam, it appears to the writer that it will not pay to go to the extra expense and risk necessary to carry steam or the more expensive hot water at such high pressures for this purpose alone, and it is hoped that this presentation will enable others who are required to assume responsibilities in this direction to judge for themselves what limit, everything considered, is the best method to adopt.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

[Report continued from page 17, issue June 4.]

(From Our Own Correspondent.)

THE fifth paper, by J. T. Hawkins, on "Education of Intuition in Machine-Designing," was discussed by Messrs. Smith, Webber, and Denton. The sixth paper, by C. E. Emery "Notes for Discussion on Cylinder Condensation," was discussed by Messrs. Denton, Stirling, Strong, and Babcock. The author states that no steel should be used for boilers unless previously properly inspected. The next paper was by same author on "Notes on Limit of Pressure in Marine Engines." The eighth paper, on "Comparative Value of Steam and Hot Water for Transmitting Heat and Power," by C. E. Emery, was discussed by Messrs. Porter, Stearns, Wolff, and Babcock. The next paper, by Albert Stearns, on "Evaporation by Exhaust Steam," was discussed by Messrs. Babcock and Miller.

In the morning of the second day's session a visit was made to the Bureau of Engraving and Printing, where the fifty-two different operations of the printing of bank-notes was witnessed; the Smithsonian Institution and the National Museum was also visited.

At 2 P. M. a third session was held, when a paper by H. R. Towne, entitled "Methods of Determining Cost and Distribution of Heat and Power," was presented, and consisted mainly of a detail of tests made by the author.

The second paper of the evening was by William Kent, entitled "A Problem in Profit-Sharing," which produced a long discussion on the labor question by Messrs. Hewitt, Hawkins, Towne, Doane, Stirling, Emery, Woolson, Scott, Fowler, and Ashworth. The remaining portion of the session was spent in discussing topical questions.

In the evening the members attended a reception given them by Hon. Josiah Dent, on U Street. The house belongs to the colonial period of the city, and is notable as the one in which Lafayette was entertained by J. C. Calhoun. The members were received in a very cordial manner and entertained with a collation and music.

In the morning of the third day a trip was made to the home of Washington at Mt. Vernon.

A dinner was served at Marshall Hall, on the opposite banks of the river, which consisted principally of plank-baked shad; this is prepared by nailing the fish to an oak plank and placing it before a wood fire, where it is kept until cooked.

In the evening the fourth session was held. A paper was presented by H. A. Ramsay on "What are the Needs of Our Navy?"

Additional interest was given to this paper from the fact that the author was on the "Merrimac" during its engagement with the "Monitor." He recommended fast cruisers which can run away from foreign iron-clads. A test of speed should be made over a measured mile, just as the English do, in order to make the comparison fair. Powerful steel-armored vessels should be built for coast defense of 14,000 tons. "From my observation in the 'Merrimac'-'Monitor' fight, I am convinced that the inclination of the resisting armor will greatly diminish the effect of the shot. On the 'Merrimac' we had only four inches of armor, yet the eleven-inch shot from the 'Monitor' all glanced, with one exception, and this shot struck us, point-blank, between wind and water, right on the knuckle, where for a short distance the shield was vertical, and this shot, although it did not get through into the vessel, broke

the iron, and sent off large splinters from the wood backing, and forced down one of the deck carlines into the engine-room." This shot, he states, was a shell and not solid. The paper was discussed by Messrs. Crane, Stratton, Kent, Smith, and Grimshaw.

The next paper was by J. Morgan, Jr., on "National Defense and its Mechanical Problems." He states, that to permit a concentration of the naval force at any desired point, the defense of any port must be completed without a navy. The writer favors forging all gun-metal, as "the difficulty of getting a good quality of gun-steel from unforged metal is great, and increases with the size." This forging process is strongly condemned by Mr. Metcalf, in his paper read before the American Society of Civil Engineers. The writer favored building up guns by shrinkage. Discussion followed by Capt. Roger Birney, Lieut. Wheeler, Stirling, Grimshaw, Emery. The session closed after a discussion of topical subjects.

Friday morning was spent by visits to public buildings, and a large number went to Cabin John Bridge, which is said to be the largest stone arch in the world.

The fifth session was in the afternoon. The first paper was by T. S. Crane, on "Direct-acting Steam Veneer-Cutter." This paper was illustrated and gave a detailed description of a knife-cutting veneer machine. Discussion followed. Then followed a paper by George H. Babcock, "New Method of Making Tubes from Solid Bars," which was a mechanical device of much interest, and discussed by Messrs. Hewitt, Spellman, Kent, Barker, Wilcox, and Stirling. The next paper, by James Dredge, on "Gas-Lighting by Incandescence."

After a short discussion on topical subjects the convention adjourned, a majority of the members leaving the headquarters at Willard's Hotel in the evening.

The following is the list of members and guests continued:

G. H. Barnes, Boston; James Butterworth, Philadelphia; A. W. Colwell, New York; T. S. Crane, Newark; J. A. Crouthers, New York; J. G. Dagron and wife, Baltimore; J. E. Denton, Hoboken; W. H. Doane, Cincinnati; W. H. Francis, Philadelphia; D. R. Fraser and wife, Chicago; N. D. Fraser, Chicago; M. P. Higgins, Worcester; C. P. Howard, Hartford; William Kent, New York; E. D. Leavitt, Jr., Cambridgeport, Mass.; T. W. Leavitt, New York; W. T. Magruder, Baltimore; C. H. P. Manning, Manchester, N. H.; C. C. Porter, New York; H. A. Ramsay, Baltimore; S. L. Randolph, Mt. Savage, Md.; A. W. Robinson, Philadelphia; — Rowell, New York; J. Rose, New York; O. Smith, Bridgeton, N. J.; S. Schutte, Philadelphia; T. B. Stearns, Denver, Col.; G. R. Stetson, New Bedford, Mass.; J. F. Steward, Chicago; E. P. Stratton, College Point, N. Y.; J. E. Sweet, Syracuse; H. R. Towne, Stamford, Conn.; G. B. Whiting, Washington, D. C.; R. R. Zell, New York; W. H. Bailey, New York; R. Inch, Washington; T. W. Barber, U. S. A.; J. H. Allen, Woodbridge, N. J.; D. Ashworth, Pittsburgh; S. E. Babcock, Little Falls, N. Y.; S. W. Baldwin, New York; C. W. Copeland, New York; M. N. Farney, New York; S. A. Hand, Toughkenamon, Pa.; C. S. Huston, Coatesville, Pa.; J. Livingston, New York; — Ruthersworth, Philadelphia; H. See, Philadelphia; J. Walker, Cleveland; G. C. Hawkins, Boston.

CONNECTICUT CIVIL ENGINEERS' AND SURVEYORS' ASSOCIATION.

A REGULAR meeting of Connecticut Civil Engineers' and Surveyors' Association was held at C. E. Chandler's office, Norwich, Conn., June 7.

The following new members were elected: R. C. P. Coggeshall, C. E., Superintendent Water-Works, New Bedford, Mass.; A. B. Drake, City Engineer, New Bedford, Mass.; L. A. Taylor, C. E., of Boston, Mass., Engineer for W. C. McClallan, contractor; C. H. Truesdell, C. E., of Central Village, Conn.; Joel M. Wheeler, Engineer of the Ansonia Brass and Copper Co., Ansonia, Conn.; J. E. Dutton, Engineer Gates & Parks' Granite Works, Niantic Conn.; C. V. Pendleton, C. E., Superintendent Substructures Berlin Bridge Co., E. Berlin, Conn.; Edgar Clark, C. E., Putnam, Conn.; Henry T. Potter, Consulting Engineer, Norwichtown, Conn.; Robert R. Smith, C. E.

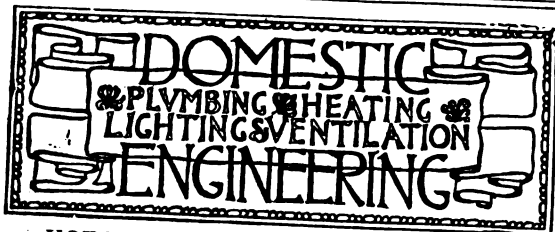
The morning was spent in visiting the Norwich Bleaching, Dyeing and Printing Co.'s works, through courtesy of E. P. Gardner, engineer for the company and member of the association, and the Greenville Dam, through courtesy of Hiram Cook, C. E., President of the Norwich Water-Power Co. The special features of the Greenville sewers were shown by the city's engineers.

After dinner at the Wauregan House, a second excursion was made in company with the Mayor, members of the Board of Water Commissioners, and the Superintendent of the Water-Works, which included a visit to Norwich Falls, a drive around the Norwich City reservoir, and a visit to the Ponemah Mills Dam.

In the evening a paper was read by W. H. Burnett, of Norwich, on the "Relation of Photography to Engineering," illustrated by views and prints.

Notes giving facts in relation to the various works visited by the party during the day were also read.

Blue Prints of "Reservoir Dams and Embankments" and "Anchor-Ice" were distributed by W. H. Richards, of New London, and of a "Break in Brick Sewer" and "Plan Case" by C. E. Chandler.



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. VI.

(Continued from page 15.)

THE diagram Fig. 14 I have constructed to show the expansion of water according to Dalton—from mean temperature to 212° of the scale of Fahrenheit's thermometer; in other words, to show the expansion of water from the

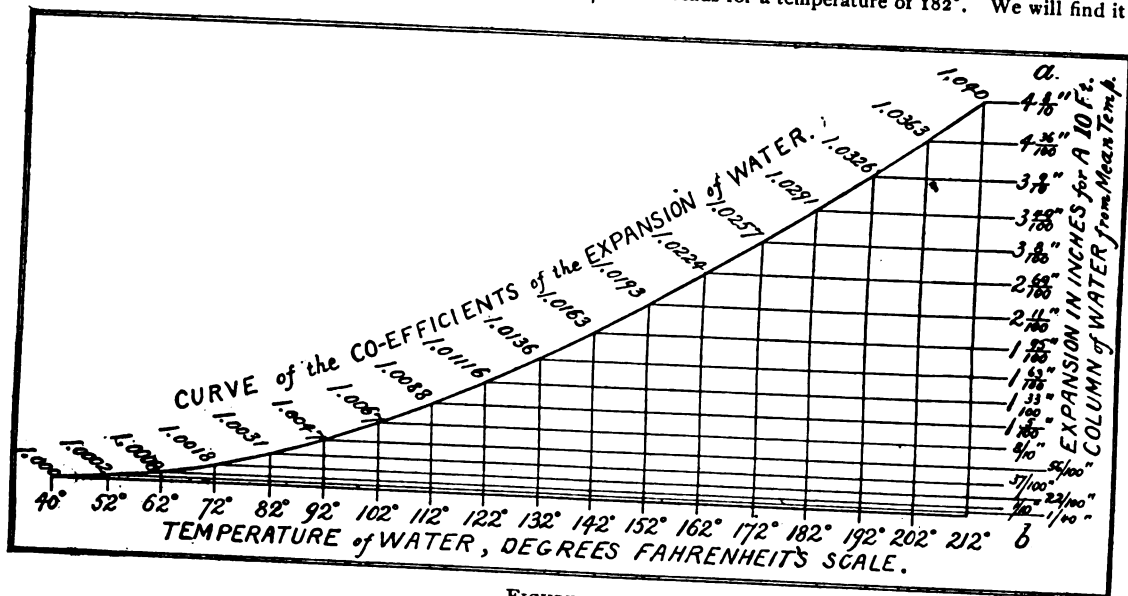


FIGURE 14.

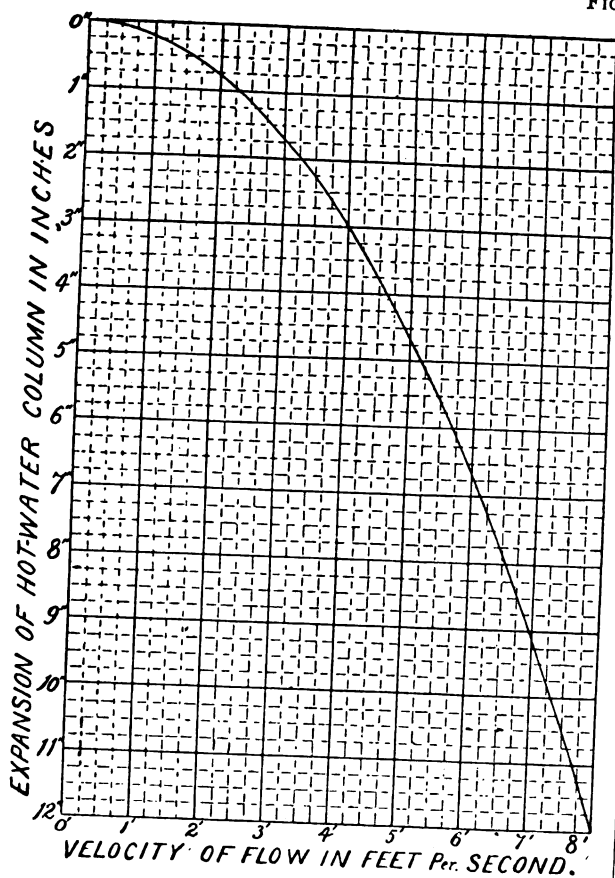


FIG. 15.

temperature at which its bulk is smallest and its density greatest to its greatest bulk and least density, under the pressure of our atmosphere at sea-level, and which covers all the ranges of temperature and bulk ever likely to take place in an open or low-pressure circulation. It will be noticed the base line is laid off into divisions of 10° Fah. (excepting the first, which is 12°) from 40° to 212°; that the perpendicular line of figures, which represent inches, is the expansion or increase of length of a ten-foot column of water when warmed from 40° Fah., and that the ordinates of the curve show the coefficients of the expansion of water irrespective of volume.

The diagram Fig. 15 has been constructed to show the

velocity of the flow of water in feet per second when the height from which it falls is known. The lower, or base and horizontal lines, are divided into feet from 0' to 8', as probably covering the greatest range of velocities found in ordinary apparatus, while the vertical lines represent in inches the expansion that will be found to take place in a column of water. It is intended that these two diagrams (Figs. 14 and 15) be used together.

For instance, let us assume we have an apparatus ten feet high, such as we might find where only one floor of a building was warmed. Let us assume now that the water goes up in the flow-pipe at a temperature of 182° Fah. and returns at 162° Fah. What then should be the greatest possible velocity of the water through the rising flow-pipe? Let us return to diagram Fig. 14 and see what the column in inches reads for a temperature of 182°. We will find it to

fifteen feet and the expansion of the water is that due to the rise of temperature between 152° and 202° Fah. For a 10-foot column, as per diagram, we find it to be 4.111'—2.111' = 2.000', which is the rise for a 10-foot column at 202° Fah. over one 152° Fah. But as our present column (Fig. 16) is 15 feet we have

$$\frac{2.25' \times 15'}{10'} = 3.375'$$

as the increase for the 15-foot column.

If we now turn to diagram Fig. 15, and approximate 3.375' on the inch column at the left, we will find where a pencil line run horizontally will cross the curve. From this point if we drop a vertical line we will find it bisects the base line at 4 1/4'—as near as we can approximate—giving us the greatest possible theoretical velocity in this case as 4 1/4' feet per second.

The velocities already spoken of are the theoretical ones, no allowance being made for friction, and they can very

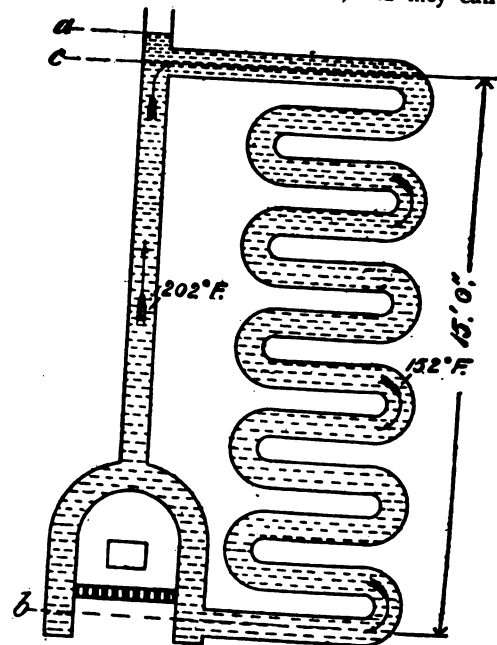


FIG. 16

nearly be obtained through a short, smooth, taper nipple or nozzle when measured at its point of smallest diameter.

ENTRY OF WATER INTO PIPES.

According to all competent authorities on hydraulics, the efflux through a circular aperture in a thin plate is only .615 of the theoretical flow, on account of the convergence of the

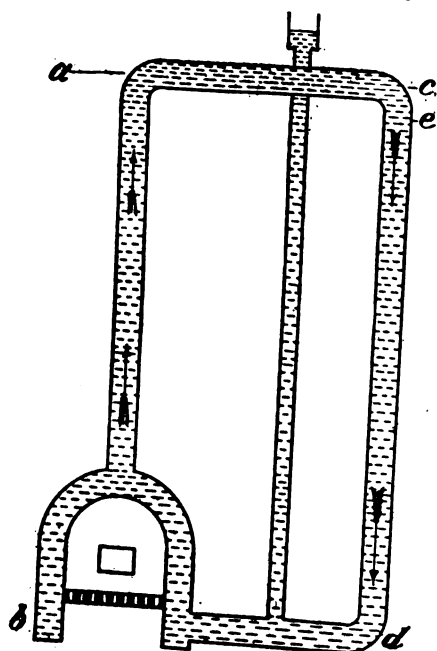


FIG. 17

current at a short distance outside the plate. We, however, have nothing to do with such conditions, unless it should be to roughly calculate the time a vessel would take to become empty through a plug-hole, and which would be out of place here.

When an aperture is through a considerable thickness or through a short parallel tube projecting outwards, whose length is not less than twice its diameter the discharge has

be 3.111 inches. Now see what it is for a column at 162°, and we find it 2.111, the difference being 1/8 of an inch. If we now turn to diagram Fig. 15, and approximate .8 of an inch on the vertical scale of inches, we will find that a horizontal line drawn with our pencil so as to start at 1/8 of an inch, will cross the curve line just where the two-foot velocity line crosses it, showing that for a fall of a little over 3/4 of an inch we have a velocity of flow in our pipe of two feet per second. Let us take another example of the same, the better to understand the use of the diagrams.

Suppose we have an apparatus fifteen feet high as shown in Fig. 16. We have now to find the measure of the difference of weight or power that keeps up the circulation in this apparatus. Heretofore we have spoken of the height from which the water falls, but it may appear to the beginner that the water cannot fall in an apparatus of this kind, as it is practically closed, and that there is therefore something to be explained, that the theory of a falling body may harmonize with the water rushing through the pipes of such an apparatus.

Really, there is a hydrostatic head or its equivalent. It may be likened to the increased weight of the cold leg of the syphon or the lessened weight of the warm leg. In the case of an apparatus as in Fig. 16 one may readily think he sees where the head comes in play in producing circulation, as the distance *ac* readily appears to be due to the expansion of the column *cd*, but in Fig. 17 it is not apparent at all. Nevertheless, to consider the question of velocity in pipes, we are bound either to consider the fall of the water in the hot column from *a* to *c* (Fig. 16), or the fall of the cold column from *c* to *e* (Fig. 17), which latter is the measure between the columns *ab* and *cd* for equal weights. It, therefore, matters nothing to us practically whether we consider the height *ac*, Fig. 15, or the height *ce*, Fig. 17, as the measure of the flow, as the result will be practically the same, as any one conversant with the laws of hydraulics knows.

Our diagram, Fig. 14, was made on the increase of height of a column of water due to expansion and not on the decrease due to contraction: therefore we will speak of the head which produces circulation the same as we would of the total head from a reservoir that produces the discharge through apertures or pipes and on which the velocity of efflux or movement depends.

We will return to our example, Fig. 16, to familiarize ourselves with the use of the diagrams. The height *cd* is

been found to be greater than when it is through a plate, and although a contraction of the water takes place it is less than in the former case, reducing the water passed to a little over .8 of the total theoretical quantity due to the head and aperture. This loss is due to the entry of the water into the pipe, there being a reduction or contraction of the water by convergence of its particles which reduces the area of the stream for a short distance within the pipe, and as the velocity at this reduced area is the theoretical one, it stands to reason the amount of water passed is proportional only to the area of the contraction compared to the area of the pipe.

The loss therefore due to the entry into the common form of pipe must be taken as two-tenths of the whole quantity that would be ordinarily supposed to pass, and must be considered separately from the loss due to friction in a long pipe, and must be added thereto and also to the loss for bends, elbows, etc., when the latter is known, as will be explained later.

(TO BE CONTINUED.)

DEFECTIVE HOT-WATER CIRCULATION.

NEW YORK, May 28, 1887.

SIR: (1) If the correspondent who writes from Hartford will fit boiler up as per accompanying sketch he will not be annoyed further. This will give him hot water in ten minutes.

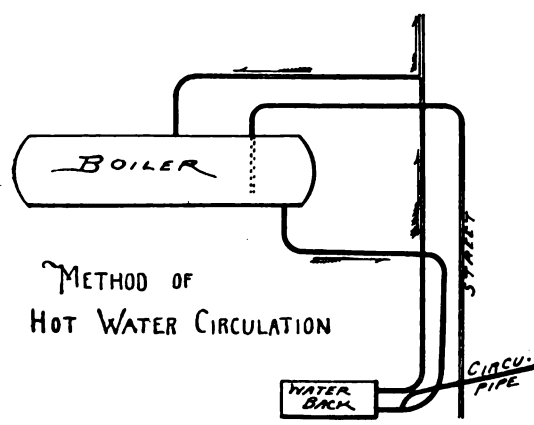


FIG. 1.

(2) I would be obliged to you for a little sketch as to how I can heat a back parlor by means of hot-water circulation from kitchen water-back. Room is directly over kitchen. Yours very truly, L. D. H.

[1. By the above arrangement (Fig. 1) our Hartford correspondent (H.) will receive a limited quantity of warm water at a basin in a very much shorter time, after the starting of a fire, than with the plan shown in his diagram (page 689, of our issue May 28), for the reason that he will draw the water directly through the water-back without its passing through the boiler. If he

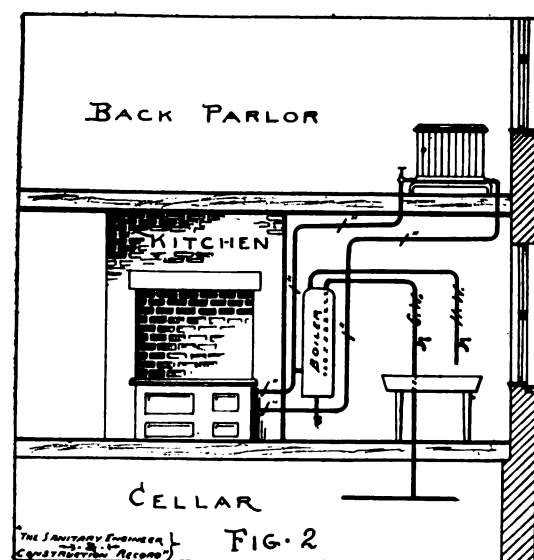
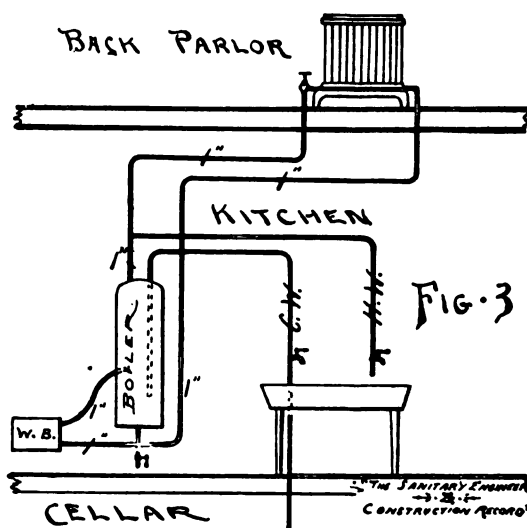


FIG. 2.

has to draw a large quantity of water, however, as for a bath, the gain in time is not so apparent, if at all, for the reason water will not warm as fast as it will be drawn.

2. In the matter of warming a back parlor from a water-back, we would suggest the plan shown in Fig. 2, if the warming of the room is of more importance than the warming of the water in the boiler. If, on the other hand, the water at a sink or lavatory is of the greatest importance and the desire to warm the room secondary, arrange it as in Fig. 3. Let the flow and return pipes be all 1-inch in

diameter, with easy and long bends, and use a vertical pipe or loop hot-water radiator of not more than forty square feet for a 1-inch pipe connection. Ream the ends of the pipes and clean all obstructions to flow. Even if the couplings or nipples of the water-back are only three-quarter inches increase the size of the flow and return pipe as stated, and do it with 1x3/4 couplings at once.



N. B.—Unless you have a good water-back, etc., we would not advise the warming of a room by such means; though when you have a valve on the radiator you can close it should you find the boiler not sufficiently hot. Still it is sometimes successfully performed for both purposes, and a plate-warmer in dining-room may be fitted this way nicely, without taking too much heat from the boiler.]

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

BUILDING CONSTRUCTION IN JAPAN.

NEW YORK, June 4, 1887.

SIR: The posts spoken of by Mr. Conder, Professor of Architecture at Tokio (THE SANITARY ENGINEER AND CONSTRUCTION RECORD, June 4), which he imagines are placed in the centre of pagodas for the purpose of stiffening the structure in case of earthquakes, and which, to his surprise, do not touch the ground, are pendulums suspended from the roof, which, having a vibration of their own (the moment the building begins to sway under the influence of an earthquake), counteracts the vibration of the building as a whole. Yours, LEOPOLD EIDLITZ.

ZINC PLATES.

June 2, 1887.

SIR: Can you inform me if there is any plate-zinc made in this country about one-eighth of an inch in thickness, and if so what size of plates they make, and where? Yours, A. LEAYS.

[Write to some firm of metal dealers.]

PLUMBING CATECHISM QUERY.

NEW YORK, June 6, 1887.

SIR: In reply to Mr. Knight's query in your issue of the 4th inst., I would say that the reply to which he refers was somewhat incomplete. It would have been better to have stated that under the conditions named a deep-seal trap, like a pot-trap, would have been preferable so far as resisting syphonic action. E. M.

SIZE OF VENTILATING-PIPE FOR A ROOM.

SIR: I should like very much to have your valuable advice in regard to the necessary square area of a metallic pipe, sufficient to ventilate a room 35'x40'x11' high. No steam-coils or fans or any other power can be used. The pipe will be placed on the outside wall and runs seventy feet above the room to be ventilated. How many square inches in pipe would you advise me to use for each 1,000 cubic feet of room to be ventilated? What book would you advise me to buy for a perfect study of ventila-

tion? By answering the above questions you would bestow a great favor upon

READER.

[To answer the above question it is necessary to know what the room is to be used for and how many persons are to occupy it. If the room is to be warmed by heated air it will probably be necessary to change the air in the room three times per hour to secure satisfactory warming in cold weather. As the room contains 15,400 cubic feet, this would require a change of air of about thirteen cubic feet per second, which could be readily disposed of by a pipe having three square feet of area. This, however, is the smallest part of the problem. A metal pipe seventy feet high on an outside wall will chill so rapidly that it is the worst possible kind of ventilating-flue in cold weather. The real difficulty is probably to get the fresh air into the room and have it satisfactorily distributed. The best book to consult on this subject is "The Principles of Ventilation and Heating and their Practical Application," by Dr. John S. Billings, U. S. A. Sold by the Book Department of THE SANITARY ENGINEER & CONSTRUCTION RECORD. Price, \$3.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
June 4.....	26.71	21.11	22.95	30.61	28.43	24.98	31.18

E. G. LOVE, Ph.D., Gas Examiner.

MUNICIPAL IMPROVEMENTS AT BIRMINGHAM, ALA.

A CORRESPONDENT of the *Commercial Gazette* says that Birmingham, Ala., has fourteen miles of pipe sewers, and will build four miles this summer, besides several large sewers for removal of surface-water. He says:

"The water-supply of the town is at present neither sufficient nor of the best quality. The present water-works were built for a town of three or four thousand inhabitants, and proves now to be inadequate.

"The supply is gotten from Village Creek, a small mountain creek, by damming it up and catching the surface-water, with a few springs to assist in feeding it. This makes the water subject to great changes during the rainy season. It is often very muddy. They have no way to filter it, and this causes considerable complaint. The company enters the city through a 22-inch main, and has twenty-five miles of pipe laid.

"The Elyton Land Company are now building new water-works. They will bring water through an aqueduct six miles long.

"One important feature is a special reservoir for the south side, placed high up on the mountains to give them as much fire-pressure as possible. It is calculated to give a pressure of ninety pounds.

"There are now fifty fire-plugs. Seventy-eight more will be added this summer.

"Granite paving is now being laid."

BROOKLYN HEALTH REPORT FOR 1886.

THE annual report of the Department of Health of the city of Brooklyn for the year 1886, by A. Otterson, M. D., Commissioner, differs from most municipal sanitary reports in that it contains no detailed tables of vital statistics. Dr. Otterson states, however, that the mortality-rate of the city for the year was 21.44 per 1,000, the estimated population, including that of the new Twenty-sixth Ward, being 745,108. The most interesting part of the book to sanitarians is that relating to the work of the chemists of the department contained in Appendix I. This includes reports on foods and food products by the Chief Chemist, Dr. E. H. Bartley; reports on factory and nuisance inspections, by O. Grothe; and on oil refineries, and on the use of copper in foods, by W. H. Kent. Under date of December 14, 1885, is a special report by Dr. Bartley on the water-supply of the city, in which he pointed out certain risks of contamination of the drove-well supply located near Spring Creek. It would have been well to have stated a year later what was done to prevent this danger. The reports on inspections of chemical work, oil refineries, etc., are very interesting, as giving accounts of the meth-

ods of disposing of sludge acid and other waste products, and of the causes of the chronic nuisances connected with Newtown Creek.

Mr. Kent seems to suspect that the laws are not carried out with regard to the disposal of sludge acid, for he finds that a considerable portion of the sulphuric acid used is unaccounted for by the amount of sludge acid reported as taken to Barren Island or dumped at sea. Taking these reports in connection with those which have been made upon the Newtown Creek nuisances by the State Board of Health, it seems tolerably plain that considerable improvement has been made in the methods of disposal of the waste products of the oil refineries, but that there is room for more, and that other waste products, with sewage, still make this creek an offensive nuisance which is unnecessary, and which under existing laws might be greatly abated.

The report of Mr. Kent on the use of copper in foods gives a good summary of the discussion on this subject in the Royal Academy of Medicine of Belgium in 1885, and sums up that such use of copper is dangerous, and should be prohibited.

Space is wanting in which to notice the other reports of the various bureaus of the Health Department, most of which are of local interest only, but which indicate that a great deal of good work has been done.

CLEAVES' METHOD OF BLUE-PRINTING.

AT the recent convention of the American Society of Mechanical Engineers Professor R. H. Thurston thus refers to this process:

"It gives me great pleasure to present to the society a copy of a very large blue print made by Professor E. C. Cleaves, of the Sibley College of Cornell University; by a new method devised by him, by means of which almost any desired size may be made.

"By the common method the larger sizes are difficult to make satisfactorily; the plate-glass needed for the apparatus is very costly and is subject to serious risk of breakage, and the whole arrangement becomes clumsy and difficult of management. By the process adopted by Professor Cleaves no plate-glass is required; the apparatus is simple and easily and conveniently handled; and the size and cost of apparatus bear very little relation the one to the other. Any size likely ever to be required in any work of the engineer can be as easily made as the smaller sizes, and the cost and difficulty of construction of the apparatus are never likely to be such as to constitute a bar to the use of this system of printing. There is no practical difficulty in getting up an apparatus to print a drawing ten feet wide and thirty feet long, if it should be found desirable. That here exhibited in illustration of what can be done is three and one-half feet wide and eight feet long, and is probably the largest blue print yet made by any process.

"Professor Cleaves' apparatus consists merely of a cylinder of a length exceeding that of the widest drawing to be reproduced, and of a diameter such that the longest tracing to be used can be wrapped around it with sufficient space to spare to give room for the clamps by which it is drawn into place and held. The cylinder is smoothly covered with felt and the sensitive paper carefully wrapped about it, the tracing to be copied being drawn over the whole and held smoothly in place by spring-clamps which seize its ends. It is found to be easy to lay the tracing smoothly over the surface, and to draw it into contact so perfectly that the work done by this method is even better and more certain than that produced by the ordinary plate-glass apparatus, even with the air-cushion now so successfully used with it. The print shown has a defect at one corner; but it is the only defective one yet made, and was selected to send simply because it was feared that there might be some danger in sending it by express, and it was preferred to risk this rather than another. It is easy, with a little care and with some practice, to make these prints absolutely perfect, much easier than with glass.

"The apparatus being ready for use, it is mounted on a cradle, supported by its gudgeons, and is revolved in the sun by means of a cord leading from some convenient line of shafting; or it may be turned by hand until the exposure is satisfactorily complete. It requires a little more time to print a sheet by this method than by the old, as the tracing and the underlying sensitive paper is but one-half the time exposed to the rays of the sun. With these exceptionally large prints, however, for which only this process would be employed, this is not an important matter. They are not likely to be made every day."

CINCINNATI CHAPTER OF AMERICAN INSTITUTE OF ARCHITECTS ON CINCINNATI ARMORY COMPETITION.

WHEREAS, The Board of Armory Trustees of Hamilton County, O., have advertised for architects to submit plans, drawings, and specifications for an armory in the city of Cincinnati, and as the said Armory Trustees have offered no compensation for such services rendered, nor any premium for meritorious design, nor appointed an expert jury to pass upon the merits of the same, and have, moreover, limited the time for the preparation of such drawings to the short period of twenty-eight days; and whereas, the Cincinnati Chapter of Architects has adopted a code governing competitions,

Resolved, That a committee of five be appointed to present said code for the consideration of the Board of Armory Trustees, and to request them to modify their conditions in conformity with the said code, and to give a reasonable amount of time for the preparation of such designs.

And be it further resolved, That a copy of these resolutions be forwarded to the press for publication.

On motion the following committee was appointed to present the above resolutions to the above Board of Armory Trustees: Messrs. James W. McLaughlin, Charles Crapsey, H. E. Siter, Gustave Drach, Lucian F. Plympton.

NEW YORK ARCHITECTURAL LEAGUE.

THE last meeting of the Architectural League, prior to the summer adjournment, was held at Morrelli's on the evening of June 6, some forty members being present. The especial feature of the occasion was an informal exhibition of drawings by Mr. Clarence S. Luce and Mr. Prentice Treadwell. Mr. Luce's drawings are always delightful from their crisp and taking rendering, and there are few draughtsmen who are so successful in both pen and ink and color.

Mr. Treadwell showed the original sketches for the decoration of the Metropolitan Opera House, a scheme for a "Great Hall" in a California house, a beautiful frieze on buff linen, together with a number of designs for glass, stuffs, etc.

The Executive Committee, through Mr. Crowninshield, its chairman, made a progressive report.

The Committee on Current Work announced that it had decided upon a mid-summer excursion and desired to be informed as to where the League desired to go. It was resolved to go to Newport, Boston, and North Easton.

The meeting adjourned to the first Monday in September.

WESTERN ASSOCIATION OF ARCHITECTS.

THERE will be a meeting of the Board of Directors of the Western Association of Architects, on Saturday, June 18, 1887, at Cincinnati, O. Petitions for the admission of new members or business of any kind may be submitted for action. It is requested that any matter to be submitted be sent to the secretary's office on or before June 15, 1887. James F. Alexander, Lafayette, Ind., is the secretary.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE annual convention for the year 1887 will begin at New York City, July 1, 1887. Members are invited to meet informally at the Society House, 127 East 23d Street, New York, on Thursday evening, June 30.

On Friday morning, July 1, the party will proceed by steamer to Rondout, and thence by the Ulster and Delaware Railroad, the Stony Clove and Catskill Mountain Railroad, and the Kaaterskill Railroad, to the Hotel Kaaterskill, Catskill Mountains, N. Y., arriving in the afternoon.

Sessions for the convention for professional discussion and one for the transaction of business will be held.

An excursion will be made during the week beginning July 3, to visit, on invitation of the Union Bridge Company, the Poughkeepsie Bridge and the city of Poughkeepsie. An excursion will also be made to the cement works and quarries of the Rosendale cement rock at Binnewater, on invitation of Mr. F. O. Norton, F. Am. Soc. C. E.

The Fourth of July will be spent at the Hotel Kaaterskill, where, in the evening, there will be fire-works and a ball.

On the evening of one of the other days of the convention there will be a banquet.

The President of the Society, William E. Worthen, Esq., will deliver the annual address at one of the sessions of the convention.

The arrangements made by the committee provide for return to New York on Friday, July 8.

The arrangements secured for transportation to New York and return are announced in circular form. In order to secure the benefit of these arrangements the instructions contained in that circular must be strictly followed.

The arrangement for special fares has been made with the Trunk Line Association Passenger Committee and with the Central Traffic Association Passenger Department, each for the lines composing such association. Full fare must be paid to New York by each person attending the convention. A return ticket will be sold at New York at one-third fare to persons holding the required certificate, properly endorsed by the Secretary at the convention. For all purposes connected with this special arrangement, *the place of the convention is to be considered and stated as New York*. The trip to and from the Hotel Kaaterskill will be otherwise arranged.

Those who find it impracticable to join the party on the morning of July 1 can proceed from New York either by rail direct, or via the Hudson River, to the Hotel Kaaterskill at any time.

As the summits of the Catskills are usually cold during hot weather, it is advisable to come provided with warm outer garments.

Members of the Society are invited to transmit to the Secretary papers they are willing to present at this convention, in order that a place may be given them in the programme.

The families of members are invited to accompany them to the convention.

The rate at the hotel will be \$3 per day.

The probability seems to be that this convention will have a very large attendance from all parts of the country. The Committee of Arrangements is William G. Hamilton, Stevenson Towle, John Bogart.

ENGINEERS' CLUB OF PHILADELPHIA.

THE regular meeting of the Engineers' Club of Philadelphia was held June 4, 1887, President T. M. Cleemann in the chair; eighteen members and one visitor present.

Owing to the unexpected absence of the author, the paper of the evening had to be deferred.

The evening was, however, profitably spent in a general discussion of the proportions and strengths of certain structures which can hardly be calculated with mathematical precision, such as floors built up of separate layers of boards, ribbed and perforated cast-iron chamber and man-hole covers, balloon frame buildings, etc. Some interesting illustrations were presented.

RUDOLPH HERING'S WORK IN CHICAGO.

[From the *Chicago Tribune*, June 4]

"It is not true that Engineer Hering has been relieved from the Drainage Commission, as falsely alleged by an evening print," said City Engineer Artingstall yesterday. The work of his office has simply been transferred to the City Engineer's office, but the commission remains unchanged. The change was made because it was thought unnecessarily expensive to run the two offices."

Mendacious and malicious reports such as that which Mr. Artingstall contradicts have appeared in a penny paper of this city from time to time during the last three or four months. The expert engineer must have snubbed some of the busybodies connected with the alleged newspaper in question. The fact is that Mr. Hering is to continue in the city's service until he performs the duties for which he was called here. He has no intention of leaving the city. There is no conflict between him and Mr. Artingstall, and Mayor Roche has no intention of discharging him. Mr. Hering is a very capable man who acquired a splendid reputation before he came to Chicago through his work for the National Government and as consulting engineer in Eastern cities.

PERSONAL.

COLUMBIA COLLEGE conferred the following among other degrees at Commencement exercises this week:

Engineer of Mines.—W. H. Aldridge, J. R. Bien, A. L. Burns, E. Z. Burns, E. D. Church, H. M. Cole, J. Lahey, R. Lahey, H. C. Manheim, J. R. Marsh, H. P. Nichols, C. C. Restrepo, G. S. Rice, L. H. Rutherford, J. G. Seligman, F. M. Simonds, F. McM. Stanton, J. A. Staunton, Jr., F. W. Tower, G. F. D. Trask, Joseph L. Warner, Paul Oscar Wells.

Civil Engineer.—Hiram P. Bellinger, Harry G. Darwin, Charles H. Davis, A. M. Heinheimer, B. J. T. Jeup, L. McI. Luquer, H. S. MacKaye, Staunton B. Peck, Jose A. Primelles, George Rowland, Alexander Stevens, Walter L. Tyler, E. Agramonte, Jr.

Bachelor of Philosophy in Architecture.—Harry E. Donnell, Samuel E. Gage, Henry O. Hunting, Rudolph Moeller.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

THE Grant Monument Association invite sketches or designs for a monument or memorial building to be erected at Riverside Park, in the city of New York, over the tomb of Gen. Grant. The association will be aided in the selection of the best design by a jury of experts consisting of eminent architects and artists to be designated hereafter. Details for the guidance of competitors may be had on application to the Grant Monument Association, 146 Broadway, New York City. Designs should be submitted on or before October 31, 1887. The proposed structure should be built of granite, marble, bronze, or other appropriate material, either singly or in combination, and may include both architecture and sculpture.

Dated New York, June 9, 1887.
Alouzo B. Cornell, Chairman Executive Committee,
Grant Monument Association.
Richard T. Greener, Secretary.

A PROTEST FROM ARCHITECTS

THE following dispatch from Washington appears in the San Francisco *Daily Alta*:

"Cluss & Schultz, architects, of this city, were awarded the premium of \$500 for the best plan for the Catholic University, and furnished detailed drawings, receiving the money therefor. The committee then awarded the building contract to Baldwin, a Baltimore architect. Whereupon Cluss & Schultz wrote an earnest protest to Archbishop Williams, claiming that they entered the competition with the understanding that the successful architects were to have charge of the erection of the building, and would not have done so otherwise, and they will not permit any one else to erect a building on their plans. They notify the Archbishop that they will ask the courts to enjoin him from any further use of them."

On inquiry our Washington correspondent learns that the terms of the competition were that the successful architect was to receive the first premium of \$500, and if his plans were adopted, 2½ per cent. on the cost of the building, for making the detail drawings, from which the \$500 was to be deducted. It is for this difference between \$500 and the 2½ per cent. on the cost of the building that Messrs. Cluss & Schultz are contending for and not for the superintendence of the building, and if their plan is being utilized in any way they certainly are entitled to it.

SEMI-ANNUAL MEETING OF THE MAKERS OF BRASS AND IRON FOR STEAM, GAS AND WATER-WORKS.

THE semi-annual meeting of this association began its sessions in Cleveland June 8. The object of this association, as our readers know, is to promote the interests of persons engaged in this industry and, so far as possible, by concerted action, prevent strikes. The officers are: President, Arad T. Foster; Vice-Presidents, George T. Coppins, Edward Worcester, and Charles Harrison; Treasurer, John M. Peck; Secretary, S. L. Morrison; Executive Committee, A. T. Foster, R. T. Crane, E. H. Cole, James Powell, and John Harlin; Business Committee, Edward Worcester, John Clifford, W. H. Douglas, W. F. Kyle, G. T. Coppins, F. X. Russell, W. H. Haines, Dan P. Eells, John Pierce, Charles Jarecki, and S. L. Morrison.

The delegates in attendance at the convention in this city were as follows: Edward Worcester, Crane Bros. Manufacturing Company, Chicago; E. H. Cole, Eaton, Cole & Burnham Company, New York; John Eaton, Oil-Well Supply Company, limited, Pittsburgh; W. H. Douglas, the same firm; A. T. Foster, United Brass Company, New York; John Clifford, L. Wolff Manufacturing Company, Chicago; H. F. Peck, Peck Brothers & Co., New Haven; D. P. Eells, Belknap Manufacturing Company, Bridgeport; J. M. Peck, Haydenville Manufacturing Company, Haydenville, Mass.; George T. Coppins, Walworth Manufacturing Company, Boston; W. F. Kyle, McNab & Harlin Manufacturing Company, New York; H. C. Rouse, Lorain Manufacturing Company, Lorain; W. H. Haines, Haines, Jones & Cadbury, New York; Charles Jarecki, Jarecki Manufacturing Company, Erie; John Pierce, Haxton Steam-Heater Company, Kewanee; Charles Harrison, Charles Harrison & Co., New York; Mr. Farrell, Bailey, Farrell & Co., Pittsburgh; N. O. Nelson Manufacturing Company, St. Louis; Thomas Ahrens, Jr., Ahrens & Ott Manufacturing Company, Louisville; W. S. Payne, Fostoria; John H. McGowan, Cincinnati; James Powell, Cincinnati; Charles Pease, Buckeye Iron and Brass Works, Dayton; S. E. Morrison, of New York, secretary of the association; J. P. Farnum, Farnum's Brass Works, Cleveland; Mr. Ward, Mansfield & Co., Pittsburgh; Mr. Hodge, Dubuque Brass and Metal Company, Dubuque; Mr. Althouse, Western Brass Manufacturing Company, St. Louis; Mr. Prindle, Worswick Manufacturing Company, Cleveland; Mr. Rees, of Rees, Shook & Co., Pittsburgh.

PROPOSALS.

(Continued from page 36.)

IRON ROOF WORK at Dallas, Tex.—Treasury Department, Office of Supervising Architect, Washington, D. C., June 9, 1887. Sealed proposals will be received at this office until 2 p. m. of the 28th day of June, 1887, for the iron work required for the roof of the Court-House, etc., at Dallas, Tex. Each proposal must be accompanied by a certified check for \$300, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The plans and specification can be had, and any information obtained, by applying at this office or at the office of the Superintendent, M. E. BELL, Supervising Architect.

DREDGING. Proposals will be received until Tuesday, June 14, for dredging 15,000 cubic yards, more or less, of the basin at the Third Light House, Depot, Tompkinsville, Staten Island, N. Y. John Mills, First Lieut. Corps of Engineers, Third Light House District.

STEAM-HEATING at Rutland, Vt.—Treasury Department, Office of Supervising Architect, Washington, D. C., June 9, 1887. Sealed proposals will be received at this office until 2 p. m. of the 27th day of June, 1887, for the steam heating apparatus required for the Court-House, etc., at Rutland, Vt. Each proposal must be accompanied by a certified check for \$500, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The plans and specification and any information may be obtained by applying at this office, or at the office of the Custodian, after June 13, 1887. THOS. D. FISTER, Acting Supervising Architect.

FURNISHING 3,000 to 5,000 marble head-stones for soldiers' graves. Until July 5. Address General R. N. Batchelder, U. S. A., Office of the National Cemeteries, Washington, D. C.

DREDGING, rip-rap, etc., for channel from Salt Pond to the Ocean, Block Island. Until June 20. Address Herbert S. Milliken, Town Council, Block Island, R. I.

FURNISHING two pumping-engines, each with a capacity of 3,000,000 gallons in 24 hours, through a 20-inch pipe 750 feet long and against an elevation of 210 feet. Until June 21. Address S. S. Frederick, President of the Board of Water Commissioners, Allentown, Pa.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 32-33-34-35-36.

WATER, SEWERAGE, ETC.

LOS ANGELES, CAL. (Special).—The city of Pasadena, Cal., will this year build a sewerage system. The estimated cost of the complete system is \$250,000. That portion to be built at present will cost about \$130,000 (including farm). Aug. Mayer is the engineer.

FLORENCE, KAN.—Proposals will be received until June 15 for work and materials for a system of water-works for city of Florence, Kan. For further information address Florence Water-Supply Company.

SALAMANCA, N. Y., is extending its water-supply.

PITTSBURG, ILL.—Plans for water-works have been prepared by W. R. Coats, C. E., of Kalamazoo, Mich.

WATER COMPANY.—Organized is the Pulaski, Va., Water-Supply Company, W. C. Bullitt, President.

GALLATIN, TENN.—Address Boyer & Roscommon about water-works here.

SHARON, MASS.—The Sharon Water Company will build works.

FORT SCOTT, ARK.—The *Monitor* reports that steps will be taken very soon to obtain a system of sewers under the Act of 1887.

NEWTON, MASS.—An order is before the Aldermen appropriating \$11,300 for the drainage of the Morse Field District.

MANSFIELD, MASS.—Private parties will, it is said, offer to the State Legislature for a charter for a water company, if the town does not accept at its next town meeting the charter of the present company.

TOLEDO, O.—The east side wants an extension of the water-service. The cost is put at \$12,000.

MERCHANTVILLE, PA., has just completed a water-works after plans by Isaac Cassin, C. E., and Howard Murphy, C. E., of Philadelphia. There is a pumping-station, stand-pipe, and 28,000 feet of water-pipe.

FORT RILEY, KAN., will have a new water-works, costing \$40,000.

TITUSVILLE, FLA., is considering the question of water-works.

ST. LOUIS, MO., is dissatisfied with the quality of water furnished by the water-works, and a committee has been appointed by the City Council to see about putting in the Holly system with spring-water as a supply.

MECHANICSTOWN, MD.—The Mechanicstown Water Company has levied an assessment of \$3 per share on its capital stock of 1,000 shares, for the purpose of commencing the building of a water-works. Proposals for bids for doing the work will be asked for shortly.

PITTSBURG, PA.—The agitation in regard to an extension of the water-supply on the South Side is still going on.

CAMDEN, N. J.—The Water Committee of the Council are considering the advisability of introducing filters at the Pavonia Pumping Station. Representatives of the Hyatt and Croker systems have been before the committee. The committee consists of Messrs. Barrett, Campbell, Barber, West, and others.

BRUNSWICK, GEO.—Plans will be made for \$150,000 worth of sewerage. Address City Engineer.

PORTLAND, ME.—The Portland Water Co. have a new contract to supply the city with water for twenty years. The cost of the new work will be about \$140,000.

FARGO, DAK.—The question of the city purchasing the water-works is again being agitated.

RALEIGH, N. C.—J. C. Brewster has submitted a proposition to the Board of Aldermen for the construction of a system of sewerage for this city. The contract provides that he shall have an exclusive franchise of the works for twenty years from date of completion and acceptance, unless sooner terminated under certain provisions. Aldermen Latta, Cross, Cowper, and Horton are the committee.

DALLAS, TEX.—Mr. Brown, of New York, has made a proposition to furnish 2,000,000 gallons of water daily for \$18,000 per annum.

JEFFERSONVILLE, KY.—Organized is the Jeffersonville Water-Works Company. Horace Scott and others.

SYRACUSE, N. Y.—The City Engineer recommends the construction of an intercepting sewer for the Ninth and Fifth Wards. He estimates the diameter at six feet.

AKRON, O.—City Engineer W. D. Chapman has reported to the City Council on the necessity of constructing at least 100,000 lineal feet of sewers at once.

ENGLEWOOD, N. J.—The Improvement Association has appointed a committee to solicit subscriptions to pay for employing an expert to make a plan for sewerage for the town. In a few months water will be introduced and it is hoped a sewerage system will also be introduced.

MILWAUKEE, WIS.—The Finance Committee of the Common Council have, in accordance with the action of the Legislature, recommended the passage of two ordinances providing for the issuing of \$500,000 in water bonds and \$60,000 of South Side sewer bonds. The water bonds will be sold for the purpose of building a new intake and constructing intercepting sewers.

DETROIT, MICH.—The Board of Health has appointed a committee to lay before the City Council a request that an expert be employed to report upon the system of sewerage and its improvement.

VICKSBURG, MICH.—A vote to construct water-works in this place was lost.

GREEN ISLAND, N. Y.—The Sewer Commissioners will soon ask for bids on about five miles of sewers. John L. Fitzgerald, of Schenectady, is the engineer in charge.

CHICAGO, ILL.—Engineer Horn, of the town of Lake, has been instructed to prepare plans and specifications for the erection of a set of pumps for the Water Department, with a daily capacity of 8,000,000 gallons.

COHOSUS, N. Y.—A new 16-inch supply-pipe will be laid from the pumping-station to the new reservoir—6,500 feet. It is estimated that the work will cost \$30,000.

SOUTH PITTSBURG, TENN.—The water-works system is being extended, and about 5,000 feet of new water-mains laid.

SHERMAN, TEX.—A system of sewerage will be built in this city during this year. A system of water-works will soon be completed. The system will be owned and operated by the city.

DECATUR, ALA.—The Decatur Land and Improvement Company signed a contract June 7 with Inman & Co., of New York, for water-works, at \$200,000.

DUBLIN, VA.—A system of water-works is being constructed. For particulars address John W. Lyons.

FERNANDINA, FLA.—The time for receiving bids for building the water-works, previously reported, has been extended to July 15.

GREENVILLE, MISS.—The contract for the water-works at this place has been let to Louis Meteser, and others, of New Orleans. Work is to begin shortly.

GAS, STEAM, BUILDINGS, ETC.

WORCESTER, MASS.—Clark University is being built by Jonas G. Clark, who has given \$2,000,000 to found a university. Architect, Stephen C. Earle.

JERSEY CITY, N. J.—An electric railway is proposed to run between Bridgeton and Jersey City.

NEW ALBANY, KY.—The gas company will extend their works by building a new plant on Bank Street.

INCORPORATED is the Western Natural-Gas Company at Mendota, Ill.

CEDARVILLE, O.—The Cedarville Natural-Gas and Oil Company is a new incorporation.

MINNEAPOLIS, MINN.—The Council Committee has awarded contracts for lighting the streets as follows: For 100 lamps and posts complete to the Wheeler Electric Company, at \$10-75 a lamp; Sun Vapor and Stove Company, 100 lamps and posts complete, \$22-80; Globe Gas-Light Company, 1,000 lamps on city posts at \$18 per lamp. This makes 1,300 lights, an increase of 300 over the present number.

ROCHESTER, N. Y.—The City Council has awarded contracts for lighting the streets. Brush Electric-Light Company, 180 lamps, 2,000 candle-power, the contract to run five years, at 40 cents per lamp per night for the first two years, 28 cents for the next two years, and 27 cents for the fifth year. Rochester Electric-Light Company, 100 or more lamps, 2,000 candle-power, at 28½ cents per night, contract running five years. Edison Electric-Light Company, 700 or more incandescent lamps, 20 candle-power, at 4 cents per lamp per year for the first year, 4½ cents for the second year, 4½ cents the third year, 5½ cents the fourth year, 6 cents the fifth year.

NEW YORK CITY.—The Board of Aldermen have granted franchises to the Mutual Electric Illuminating Company, Theodore E. Otis, President, and the Union Electric Company of Rahway, N. J., E. A. Carman, President.

NEW ORLEANS, LA.—The New Orleans Gas-Light Company has begun an action in the District Court looking to the annulling of the contract with the Louisiana Electric-Light and Power Company for lighting the streets. The gas company asserts that the contract is in violation of law.

POTTSVILLE, PA.—The Town Council acted on the proposals June 7 for street-lighting. None of the bidders, excepting the local company, complying with the advertisement soliciting proposals, which required an exhibit of their respective systems, the bids were not considered.

Further action was postponed until January, 1888, in the meantime the present arrangement with the Anthracite Electric Light and Power Company, of Pottsville, continuing in force. Their rate now charged, and for which they yesterday proposed to enter into an agreement, is at the price of \$104 per annum per lamp (Schuyler system); arc-lights 2,000 nominal candle-power, to be lighted every night during the year from dark until early dawn.

MIDDLETOWN, N. Y.—It is reported that the Standard Oil Company has bought the works and franchise of the Middletown Gas-Light Company, at about \$80,000.

WASHINGTON, D. C.—Newly organized is the Automatic Water-Gas Company, with John B. Alley as President.

HARRISBURG, PA.—The Ridley Electric-Light and Power Company, of Delaware County, with a capital of \$10,000, has been chartered.

OAKLAND, CAL.—Council has taken steps to secure a site for the new city hall, which is to be soon begun. Address Mayor W. K. Davis.

SHERMAN, TEX., will extend its electric-light system.

RAILROADS, BRIDGES, CANALS.

NEWTON, KAN.—The Newton, Attica and El Paso Railroad Company has been incorporated to build 100 miles of railroad.

MILWAUKEE.—The North Harbor Pier has been condemned and C. H. Starke & Co. will tear it down, and for a distance of 600 feet erect new stone-work from the water surface up.

The plans for the new Chicago and North-western Railroad Company's bridge over the tracks at Lafayette Place are completed and have been accepted by the Board of Public Works. A petition will be circulated to raise the grade of the streets leading to the bridge, and when this is done the building of the bridge will be pushed.

TROY, N. Y.—The City Council has ordered the construction of an iron bridge over the Poestenkill at Hill street, to cost \$7,000 to \$8,000.

BRIDGE.—The Secretary of War has approved the plans for a new bridge over Cumberland River at Nashville. The estimated cost is \$100,000. The contract for the superstructure has been given to the Mt. Vernon, O., Bridge Company for substructure, and embankments to John Broderick, of Nashville. E. F. Falconet, of Nashville, is engineer in charge.

RAILROAD.—The Gulf and Ship Island Railway is rapidly constructing its line of road to connect with lines to Chicago. W. H. Hardy, of Meridian; W. C. Faulkner, of Ripley; General Wirt Adams, of Jackson, are directors.

TALLAHASSEE, FLA.—Incorporated are the Eufala and St. Andrews Bay Air-Line Railway Company, and St. Lucie and Lakeland Railway Company.

BOSTON, MASS.—Thomas Lovitt is one of the principals in the New Electric Railway Company, for which a charter was recently granted. It proposes to construct a line to Nantasket Beach.

ALLGHENY, PA.—Heman Clark & Co., of New York City, have the contract for constructing the electric railroad from the City Hall to the Perryville Road. J. J. Houghton is superintendent.

ST. PAUL.—The Board of Public Works has awarded contract for grading Irvine Avenue, from Walnut Street to Western Avenue, to Thornton & Shaw, at \$14,700.

RAILROADS.—A bill is before the New Hampshire Railroad providing for the combination of the Manchester and Lawrence and the Concord Railways into the New Hampshire Railroad. The road is to be under control of the State Legislature.

WALLULA, CAL.—G. W. Hunt, now of this place, has the contract for the construction of a railroad between here and Pendleton.

OTTAWA, ONT.—M. Kemper, representing German capitalists, has made an offer to the Government for the purchase of the Inter-Colonial Railway. The project is part of a scheme for the development of great iron mining and other operations.

NEW YORK CITY.—The Rapid Transit Commission has adopted modified plans proposed by the Manhattan Elevated Railway Company for elevated structure on South and West Streets. The cost is estimated at \$600,000 per mile.

SPRINGFIELD, ILL.—A certificate of consolidation was recorded, June 7, at the office of the Secretary of State, by the officers of the New York, Wheeling, St. Louis and Chicago Railway Company of Ohio, and the New York, Wheeling and St. Louis and Chicago Railway Company of Illinois, for the purpose of forming one corporation for the operation of a railroad from Wheeling, W. Va., to East St. Louis, Ill., and from Lancaster, Ohio, to Fort Wayne, Ind., under the name of the New York, Wheeling, St. Louis and Chicago Railway Company.

CINCINNATI, O.—Recently incorporated is the United Railways Terminal Company, of Cincinnati.

BOSTON, MASS.—It is proposed to build a \$450,000 bridge between Boston and Cambridge.

RAILROAD.—The Georgia Central Railroad is making surveys for an extension to connect with Decatur.

CASTINE, ME.—The Castine and Bangor Railroad has been incorporated. Frank P. Wood, F. H. Drummond, and others, of Bangor, directors.

ASHEVILLE, N. C., June 5.—The charter of the Atlanta, Asheville, and Baltimore Railroad has been turned over to Colonel T. J. Powell, of New York, part of the contract being that the road is to be begun in six months and finished in five years. The line will run from Roanoke, Va., to a point near the Cranberry mines in Mitchell County, N. C., then to Asheville, then to Brevard, and thence to Birmingham, Ala., passing near Atlanta, which will be reached by a branch.

RAILROAD.—The Rockland, Rockport, and Camden Railroad has begun surveys.

THE Mobile and Ohio Railroad has ordered a corps of engineers to survey and locate a line possible between Corinth, Miss., and Birmingham, Ala. The purpose is to have an air line from St. Louis to Birmingham, connecting with Georgia Pacific.

MINNEAPOLIS.—The Council Committee on Bridges will probably report amended plans of the Franklin Avenue bridge over the Mississippi, providing for a bridge with eighty feet head-room over the channel; one through span of 302 feet, and three deck spans of 176 feet each. The estimated cost of the sub-structure is \$58,752, and of the superstructure, \$79,190, making a total cost of \$137,942.

WILMINGTON, DEL.—The contract for building the iron bridge has been awarded to the Smith Bridge Co., of Toledo, at \$15,200.

DALLAS, TEX.—Messrs. A. Davis & Co., of this city, has been awarded contract to build the South-western extension of the Missouri Pacific system, from here to Hillsboro, distance six-seven miles.

BIDS OPENED.

DULUTH, MINN.—The contract for the construction of the Spalding House was awarded to Messrs. Hennessy Bros., Agnew & Cox, of St. Paul and Duluth. The contract price was not made public, but is said to be considerably more than \$300,000.

MONTREAL, CAN.—Hughes & Stephenson have the contract for plumbing and hot-water heating of the new passenger station for Grand Trunk Railroad.

HUNTINGTON, PA.—The Kelly & Jones Company, of New York, have the contract at \$26,000 for warming the Middle Penitentiary.

TORRINGTON, CONN.—The following bids for sewers were received June 7:

L. W. Burt, Hartford, Conn., \$14,047; James J. Cogan, Bergen Point, N. J., \$9,534.40; A. Braxos & Sons, Middlefield, Conn., \$10,740.95; Matthew Kehoe, New Haven, Conn., \$13,133; J. H. Austin, Bridgeport, Conn., \$10,213.20; Franklin A. Snow, Providence, R. I., \$9,933.25; Clark & Byron, New York City, \$7,840.50.

BOSTON, MASS.—The following bids for furnishing white dressed granite for the Suffolk County Court-House were received by the Court-House Commissioners at Boston June 2:

Swett & Davis, Lowell, \$103,000; Cape Ann Granite Company, Gloucester, \$139,000; Hollowell Granite Company, Hallowell, Me., \$105,600; Granite Railway Company, Quincy, \$107,700; Davis Tillson, Rockland, Me., \$85,800; W. S. White, Rockland, Me., \$98,700. The contract was awarded to Mr. Tillson, who is supposed to represent the Hurricane Granite Company, of Rockland, Me. The contract calls for about 45,000 cubic feet of stone.

EAST SAGINAW, MICH.—On June 4 proposals for constructing brick and pipe sewers in certain streets were opened by the Board of Public Works. We give the principal bids: 1,000 feet of brick sewers, 20"x30", John C. Davis, East Saginaw, \$1,200.50; J. P. & A. Davis, East Saginaw, \$2,814.70; Brookes Jackson, \$2,860.50; O'Connor & Nigier, \$2,760.50.

Three hundred and four feet of brick sewer, 30"x45", 350 feet of brick sewer, 28"x42", 510 feet of brick sewer, 24"x37 1/2", 610 feet of 18-inch pipe-sewer, 280 feet of 15-inch pipe-sewer, 300 feet of 12-inch pipe-sewer—all in Brewster street: John C. Davis, \$6,612.22; J. P. & A. Davis, \$5,906.40; T. C. Brooks, \$5,848.40; O'Connor & Nigier, \$5,221.76.

Maple street, 200 feet 23"x33 1/2" brick sewer, 420 feet of 15-inch pipe-sewer, 570 feet of 12-inch pipe-sewer: John C. Davis, \$1,610.40; J. P. & A. Davis, \$1,672.80; T. C. Brooks, \$1,790.80; O'Connor & Nigier, \$1,680.40; Kelly & Lawson, East Saginaw, \$1,790.00. The iron castings, water line, and sewer-pipe will be furnished by the Board of Public Works, the brick and other necessary material to be furnished by the contractor.

ALLEGHENY, PA.—The contract for the rails to be used on Observatory Hill Electric Road has been awarded to the Cambria Iron Co. The plant will cost about \$200,000.

ST. PAUL.—The Board of Public Works has awarded contracts as follows:

Paving—Wacouta street, from Union Depot to Ninth street, to Folsom & Murray for \$15,000; Sherburne avenue, from Rice street to a point 200 feet east of Grant street, to Folsom & Murray for \$9,400; alley in Block 5, St. Paul proper, from Cedar to Minnesota street, to Folsom & Murray for \$500.

Sewers—Sherburne avenue, from Grant to Rice street; Park avenue, from Viola to University avenue; on University avenue, from Brewster avenue to Wabasha, Grant street, from Sherburne avenue to Como avenue; Viola street, from Grant to Brewster avenue, and from Park to Rice street, to F. S. Blodgett for \$12,000.

PENOBSKOT, ME.—The following proposals for the new building of agriculture and natural history were received: C. B. Brown, Bangor, entire work, \$22,100; Lowell & Tibbetts, Bangor, entire work, \$20,500; J. M. Dove, Bangor, carpenter work, \$9,550; William N. Sawyer, Bangor, mason and stone work, \$10,495; J. & J. Philbrook, entire work, \$19,987.

MILWAUKEE.—Bids have been opened for building the new Eighth Ward Fire-Engine House, corner Eighth avenue and Maple street. John Feilenz was the lowest bidder, but as his bid exceeded the appropriation, the contract was not let.

TOPKA, KAN.—The contract for the completion of the State Capitol Building was awarded to George H. Evans & Co., of this city, for \$422,055.28. The only other parties making bids for the entire work were Henry Bennett, of this city, whose bid was \$450,308, and Charles Pierce & Co., of Chicago, at \$478,760. The following made partial bids: Chubbett & Sargeant, Rice & Bassett, J. E. Lane, Sneed & Co., of Kansas City, Terra-Cotta Lumber Co., Haugh, Ketcham & Co., and Variety Iron Works.

NEWARK, N. J.—Six bids were received for the erection of a Soldiers' Home, Newark, ranging from \$52,000 to \$120,000. The lowest bids were those of Joseph M. Smith & Brother, of Newark, for \$72,000, and Henry M. Doremus, of Newark, for \$52,000, to whom the contract was awarded.

HEMPSTEAD, L. I.—The Hempstead Gas-Light Company awarded the contract for furnishing an electric dynamo, etc., to Thomson & Houston, of Boston, and for engine and boiler to Messrs. Hampson & Co.

MONTGOMERY COUNTY, PA.—The following bids for masonry and iron work for Greenlane Iron Bridge, Swamp Creek Iron Bridge, and Jenkintown Stone Arch Bridge, were received by County Commissioners, June 4, 1887: Massillon Bridge Co., Massillon, O., Greenlane Iron Bridge, per foot \$22.50; Swamp Creek Iron Bridge, per foot \$18.50; Groton Bridge Co., Groton, N. Y., \$22.00, \$19.08; West Point Engine and Machine Co., West Point, Pa., \$24.50, \$30; Columbia Bridge Co., \$22.10, \$18.00; Mount Vernon Bridge Co., Mt. Vernon, O., \$24, \$22; Penn Bridge Co., Beaver Falls, Pa., \$22.55, \$17.00; Pittsburg Bridge Co., Pittsburg, Pa., \$25.33, \$23; Doan & Westbrook, New York City, \$26, \$24; Wrought Iron Bridge Company, Canton, Ohio, \$21.70, \$17.20; Morse Bridge Co., Youngstown, O., (ump bid) Plan 1 \$5,617, Plan 2 \$5,469; Plan 1 \$3,322, Plan 2 \$3,223; Standard Bridge Company, Philadelphia, \$18, \$15; John Denithorne & Son, Phoenixville, Pa., \$19.78, \$17.83; Berlin Iron Bridge Company, Binghamton, N. Y. (ump bid), \$5,210, \$3,465.

Masonry.—Willoughby H. Smith, Hendricks P. O., Montgomery County, Pa., Greenlane Bridge, \$1,777; Swamp Creek Bridge, \$1,444; Richard Denithorne, Phoenixville, Pa., \$1,250, \$3,300; Alex. McLean, McLean P. O., Montgomery County, Pa., Greenlane Bridge, \$4,000; Mack & Schwenck, Zieglerville, Pa., Swamp Creek Bridge, \$5,200; William Todd, \$3,930. Jenkintown Stone Arch Bridge.—Richard Denithorne, \$8,900; Hugh H. O'Neill, Jenkintown, Pa., \$4,915; Ellwood Hart, Conshohocken, Pa., \$6,922; Samuel Hart, Conshohocken, Pa., \$5,480; Mack & Schwenck, \$10,990; William Todd, \$7,131.

BALTIMORE, MD.—Contracts for the erection of storehouses, cottages, tenements, etc., at Sparrow's Point, for the Pennsylvania Steel Co., have been awarded to Mr. John G. Coder. Designs were prepared by Benjamin B. Owens, architect.

SCHENECTADY, N. Y.—The following bids for laying new mains were received by the Water Commissioners, June 7: M. Nolan, Schenectady, N. Y., Union Street extension, 6 and 4-inch mains, 2 1/2 cents per lineal foot; Terrace Place, 4-inch mains, 20c.; State Street extension, 8 and 4-inch mains, 20c.; Benjamin Van Vranken, Schenectady, 26c., 20c., 20c., per lineal foot, respectively. The work includes the setting of hydrants, gates, and gate-boxes.

NEWBURGH, N. Y.—The carpenter and brick work for the extension of the County Clerk's office has been given to William White, of Goshen, at \$15,200. J. B. and J. M. Cornell, of New York City, bid \$14,447 on the iron-work, but no action has been taken. Theirs was the only bid. Proposals for heating and plumbing will be asked for.

GOVERNMENT WORK.

NEW YORK.—The following bids were opened at the Army Building, by Lieut.-Col. Henry C. Hodges, on Thursday, June 9, for masonry and carpenter work on the Academic Building at West Point, N. Y.

Bidders: Charles H. Bunn, mason's specification, \$81,280; carpenter's specification, \$27,059; to be completed in nine months. Richard Calrow, for all, \$115,049; to be completed in six months. James L. Lowry, mason's specification, \$87,700; carpenter's specification, \$28,400; to be completed by February 9, 1888. Byrcn K. Bates, carpenter's specification, \$19,750. Lambert Kleits, carpenter's specification, \$30,500; to be completed by September 1, 1887.

No award can be made, as the figures of the lowest bidder exceed the appropriation.

JEFFERSON CITY, MO.—Synopsis of bids for earth, stone, brick and stone-work of approaches to Court-house, etc., opened June 7, by the Supervising Architect of the Treasury Department: William Trippensee, Jefferson City, \$6,700; McCarthy & Corbett, Washington, D. C., \$8,000; David McMerriam, \$8,200; Larkworthy & Menke, Quincy, Ill., \$6,787.

FORT NIAGARA, N. Y.—The following bids for construction of buildings were received by the Quartermaster's Department, June 2:

BIDDERS.	Brick barracks building, complete.	Brick storehouses, complete building.	TOTAL.
John H. O'Rourke, Brooklyn, N. Y.	\$23,945	\$15,400	\$39,345
John Calvert, Youngstown, N. Y.	10,498	8,200	18,698*
John E. Riordan, Youngstown, N. Y.	10,945	8,500	19,445
R. J. Getz, Buffalo, N. Y.	.....	.....	20,754

*Accepted.

PARKERSBURG, W. VA.—Synopsis of bids for hydraulic passenger elevators for Court-House, etc., opened June 7 by the Supervising Architect of the Treasury Department: Crane Elevator Co., Chicago, Ill., \$7,800; Geo. C. Howard, Philadelphia, Pa., \$3,822; Ellisthorpe Air-Brake Co., Chicago, Ill., \$3,070; gas-engine and screw machine in place of hydraulic service, \$2,700.

SYNOPSIS of bids opened June 6, 1887, by Colonel S. T. Abert, for removal of wreck in Rappahannock River, Virginia: John L. Johnson, Fulton, N. Y., \$3,000; William H. French, Norfolk, Va., \$1,195.

LEXINGTON, KY.—Synopsis of bids for masonry of superstructure of Post-Office, etc., opened June 4 by the Supervising Architect of the Treasury Department: The Southern Construction and Quarry Company, Petros, Wayne County, quarry, Oolitic limestone, \$32,551.23; Belknap & Dumesnil Stone Company, Bowling Green, Ky., \$31,000; John Boyle, Cincinnati, Ohio,

Hoosier Stone Company, quarry, Oolitic limestone, \$40,200; Buff Amherst, \$41,587; Indiana Salem Stone, \$40,200; Cleveland bluestone, \$40,108; Ohio River freestone, \$38,064; D. V. Johnson, Hoosier Stone Company, quarry, Bedford Oolitic, \$35,000; Blatz & Krebs, Dork Hollow Quarry, Buff Bedford, \$41,661; Dumesnil Bros., Dork Hollow Quarry, Bedford limestone, \$37,200; John Moore, Dork Hollow Quarry, Bedford limestone, \$55,828; McCarthy & Corbett, Washington, D. C., Dork Hollow Quarry, Bedford limestone, \$40,669; John Diebold, Dork Hollow Quarry, Bedford limestone, \$39,973.

PEORIA, ILL.—Synopsis of bids for joiners' work, wood-flooring, etc., of Post-Office Court-House, etc., opened June 6 by the Supervising Architect of the Treasury Department:

BIDDERS.	Amounts for different kinds of finish.			Rate per sq ft. for Addl Floor-ing.
	White Oak.	Cherry.	Mahogany.	
Truesdale Mfg. Co.	\$31,420.00	\$34,325.00	\$38,685.00	10 1/2 c.
John O'Connor	37,000.00	38,500.00	40,000.00	12 1/2
Cudell & Lehman	33,264.00	35,690.00	38,118.00	12 1/2
John Moore	26,500.00	27,700.00	31,180.00	20
John Mitchell	28,896.81	31,897.00	36,397.00	10
Robert Mitchell Fur. Co.	26,382.85	27,985.85	30,221.85	12 1/2

DETROIT, MICH.—Abstract of proposals for constructing 300 feet, more or less, of elevated walk on pier at Dunkirk Harbor, N. Y., received and opened at the office of U. S. Light House Engineer, Major S. M. Mansfield, Tenth District, Detroit, Mich., June 4, under advertisement of May 16: Walter K. Williams, Dunkirk, N. Y., material and labor of all kinds necessary for building walk at per lineal foot in place, \$1.14; William J. Harris, East Avon, N. Y., \$1.18.

PROPOSALS for removal of wreck of sunken steamboat "Marie A." lying near Charenton, La. Bids opened by Major W. H. Heuer: John H. Gardner, New Orleans, La., \$660; Peter Usner, New Orleans, La., \$875; John J. Atkinson, Houston, Texas, \$575; James C. Bains, New Orleans, La., \$1,850; Samuel W. Skinner, Wilmington, N. C., \$1,800; William H. Brown, New Orleans, La., \$475; Harry Freeman, Franklin, La., \$450; Lewis Anzures, New Iberia, La., \$350; William L. Campbell, Mobile, Ala., \$1,425; William Evans, New Orleans, La., \$600; Victor Von Schoeler, Franklin, La., \$500.

ABSTRACT of proposals for dredging in the Thames River, Conn., received in response to advertisement dated May 7, and opened June 6 by Lieut.-Col. D. C. Houston, Corps of Engineers: Richard Parrott, 355 Broadway, Newburg, N. Y., 36c. per cubic yard; total for 40,000 cubic yards, \$14,400. Hartford Dredging Co., Hartford, Conn., 22c. per cubic yard; total for 40,000 cubic yards, \$8,800. Lowest bid.

TOLEDO, O.—The following bids for dredging at Toledo Harbor, O. (straight channel), were received by Major L. Cooper Overman, U. S. A., May 31. Rate per cubic yard, scow measurement: Stang & Gilmore, Lorain, O., for all the dredging 25c. for a part of the dredging 22c.; J. M. Elvy & Louis J. Seck, Toledo, O., for all the dredging, 24 1/2 c.; William St. John, Toledo, O., for part of the dredging 24c.; Charles F. Dunbar, Buffalo, N. Y., for all the dredging, 27c.; Dodge & Petree, Chicago, Ill., for part of the dredging, 33c.; Charles B. Crane, Chicago, Ill., for all the dredging, 27c.; L. P. & J. A. Smith, Cleveland, O., 24c., 25c.; George Talbot, Buffalo, N. Y., 20c., 21c.; Carlin, Stickney & Cram, East Saginaw, Mich., for all the dredging, 23 1/2 c.; Edwin H. French, Fulton, N. Y., for part of the dredging, 22 1/2 c.

MISCELLANEOUS.

MILWAUKEE, WIS.—The Board of Public Works has opened bids for furnishing the Fire Department with 1,000 feet of 2 1/2-inch hose from A. H. Gardner & Co., H. J. Delaney & Co., American Fire-Hose Company, Richard J. Thomas, and Rundle & Speece, ranging from 68 cents per lineal foot to 90 cents. The bid of 68 cents was for single-body hose, which was thought too high, and the board will advertise for bids making specifications which will exclude single-body hose.

PHOENIX, ARIZ. May 24.—A number of capitalists have combined in the formation of the Arizona Improvement Company, with headquarters in this city. The business of the company includes the taking of water and lands, maintaining and operating an electrical apparatus for lighting purposes, driving machinery, etc., and carrying on the business of banking, merchandising and common carriers. The capital stock of the company is placed at \$3,000,000. The Board of Directors has organized, with the following officers: De Barth Shorb, President; W. J. Murphy, First Vice-President; F. W. Sharon, Second Vice-President; Clark Churchill, Third Vice-President; William Christy, General Manager; C. Churchill, General Solicitor; W. D. Fulwiler, Secretary.

BRAINTREE, June 6, 1887.—The officers of the Baintree Water-Supply Company were to-day served with an injunction prohibiting them from continuing the work of construction of their works, pending the decision of the Supreme Court in the case of the Company vs. the Town of Baintree.—*Boston Herald.*

DULUTH.—The Duluth and North-Western Smelting Works have advertised for 2,000,000 bricks, to be used in the erection of furnaces, etc. It is said that the building of the works will require 15,000,000 bricks.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; As duell, brown-stone dwelling; apart house, apart-house; ten, tenement; c, each; o, owner; a, architect; b, builder; fr, frame.

AMONG THE ARCHITECTS.

We report the following from the offices of New York City:

Asheville, N. C.—Brick and stone convent, three stories and basement; dimensions, 83x97; for the Rev. T. Frederick Price; plans are also being prepared for a church and parsonage to be erected on the same grounds; Messrs. Paliser & Paliser, Architects.

Sanesville, Fla.—Presbyterian church; to be of brick and stone; dimensions 72x80; for J. D. Mathewson, President of the Board of Managers; architects, Messrs. Paliser, Paliser & Co.

Jersey City, N. J.—Parochial school, to be erected on Van Winkle Street; for the Rev. B. Ter Woot; dimensions, 50x75; cost, \$15,000; a sisters' house and church are to be erected on the same grounds; Messrs. Paliser, Paliser & Co., architects.

BROOKLYN.—The bids opened by the Board of Supervisors, June 9, for the erection of buildings at the St. Johnland County Farm, were found to be unsatisfactory, as sufficient notice had not been given, and they will be readvertised. A very large sum of money is involved in this matter.

NEW YORK CITY.

111 Madison, br ten; cost, \$11,000; o, Adam Moran; a, George M Walgrove.

204-206 s E 126th, br auction rooms; cost, \$10,000; o, Sarah E Cooke; a, Cleverdon & Putzel.

S e cor Madison av and 109th, br stores and dwells cost, \$5,000; o, Hickey & Brady; a, Zeigler & Wenz.

E s Madison av, 25 s 109th, 3 br dwells; cost, \$34,000 all; o and a, as above.

E s Madison av, 100 s 109th, 3 br dwells; cost, \$52,000 all; o and a, as above.

54-56 E 83d, 4 br dwells; cost, \$9,000 all; o, Fred Cornell and Charles Gulden; a, F A Minuth.

S e cor 9th av and 53d, br dwell; cost, \$30,000; o, Wm B Finley; a, James W Cole.

S s 95th, 80 e 9th av, br ten; cost, \$20,000; o, Francis McQuade; a, A B Ogden & Son.

N s 94th, 80 e 9th av, br ten; cost, \$20,000; o and a, as above.

574-578 Eleventh av, 3 br tens; cost, \$39,000 all; o, Mrs Mary W White; a, Morgan M O'Brien.

MISCELLANEOUS.

BOSTON.—Vaie st, near Thornton, manufactory and storage; cost, \$18,000; o, Dennison Manufacturing Co; a, N Kenway; b, James Fagan.

Batavia, near Falmouth, ten; cost, \$17,500; o, a, and b, David W Thomas.

Falmouth, near Batavia, 3 tens; cost, each \$17,500; o, a, and b, same as above.

32-40 Moreland, 5 dwells; cost, all \$45,500; o, Ariel Low estate; a, J H Bessrick; b, Sampson and Clark.

16-30 Cumberland, 8 dwells; cost, ea, \$9,000; o T A Johnston & J E Potter; a, Fred Pope; b, J E Potter.

30 Magnolia, fr dwell; cost, \$8,000; o, M C Weldon; a, T Frost; b, M C Weldon.

Ravine Lane, near Englewood av, fr dwell; cost, \$16,000; o, a and b, Herbert Mosely.

ALBANY, N. Y.—212-218 N 6th st, 4 3-story brick dwell; cost, \$8,000; o, W R Laufer & Co; a, L S Jacoby; b, Martz & Edwards.

1125 Walnut st, 2 story br cottage; cost, \$7,000; o, Lewis Sourwine; a, L S Jacoby; b, D H Greenwald.

22-24 S 7th st, 2 3-story br dwell; cost, \$7,000; o, Veager & Ruhe; a and b, J M Ritter.

CATASAUQUA.—Howtown Road, br church; cost, \$8,000; o, Ed Lutheran Congregation; a, L S Jacoby; b, Cain Semmel.

MINNEAPOLIS.—S S Sprague & Co, of Providence, R I, will erect business block on Nicollet av, corner 8th st, to cost \$250,000, to be seven or eight stories high. The land has already been bought.

The Board of Education has ordered the following new school buildings: Peabody building, corner Nineteenth avenue south and Two-and-a-half street, 8 rooms; Seward, old fair grounds, 12 rooms; Calhoun, Lake street, near Hennepin, 12 rooms; Everett; rebuilt, 8 rooms; Bremer, Crystal Lake, 8 rooms; Madison, addition of 8 rooms; Pureath, addition of 4 rooms, and the large addition to the high-school building.

ST. PAUL.—Exchange, near 9th, 3-story br dwell; cost, \$10,000; o, H J McCaine

At Arlington Hills, br add to pub school; cost, \$21,914; o, Board of Education.

Winnifred, near Andrew, block 2-story fr dwells; cost, \$10,000; o, Lawton Bros.

At Hamline University, 3-story Hall of Science; cost, \$30,000; o, Trustees of University.

Wabasha, near Bluff, 3-story br store and dwell; cost, \$30,000; o, A Crawford.

Franklin, near 6th, 3-story br dwell; cost, \$10,000; o, J Hammer.

Pleasant, near Walnut, add to public school; cost, \$32,487; o, Board of Education.

Snelling av, near Summit av, add to Macalister College; cost, \$60,000; o, Trustees of College.

South Robert, near Fairfield, 5-story br store; cost, \$12,000; o, J G Brady.

142 minor permits, \$131 200.

ST. LOUIS, MO.—9th and Palm sts, 2 adj br car shops; cost, \$10,000; o, St. Louis Car Co; b, Bothe & Rattermann.

9th and Palm sts, adj br car shop; cost, \$10,000; o, St. Louis Car Co; b, Bothe & Rattermann.

25th and Howard sts, 4 adj br tenements; cost, \$9,000; o, Mrs. H. O'Brien; sub let.

Oliver st and Compton av, 5 adj br dwell; cost, \$21,000; o, J M Wieners; a, A F Rosenheim; b, Francisco & Co.

DEDHAM, MASS.—Work on the new residence of Mr Albert W Nickerson, one of the largest owners of the Atchison, Topeka and Santa Fe R R Co, has begun and will be completed according to plans prepared by the late Mr H H Richardson. The expense of the house will be upward of \$100,000.

ATHENS, GFO.—The Y M C A will build a \$15,000 Association Hall. McGinty & Co are contractors.

LITTLE FALLS, N. Y.—J S Barnett & Bro. will build a new tannery building, 51x114.

NEW YORK CITY.—F E Withers has prepared plans for a pavilion hospital to be erected by the Department of Charities on Blackwell's Island. The cost is \$25,000.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 3. } PUBLISHED EVERY SATURDAY.

NEW YORK, JUNE 18, 1887.

LONDON, JULY 2, 1887.

SINGLE COPIES, TEN CENTS. } IN AMERICA
Subscription, \$4.00 per year in advance, post paid. }
SINGLE COPIES, SIXPENCE. } IN GREAT
Subscription, 20s. per annum in advance, post paid. } BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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LEAVES OF ABSENCE FOR MUNICIPAL ENGINEERS.

WE happened to be, a few weeks ago, in the office of a City Engineer, not a thousand miles from New York, where some members of the city government, having special charge of the Public Works, were informally discussing matters of local interest with the Engineer, who casually remarked that, after several years of uninterrupted work, he was glad to think that a period of comparative inactivity in the prosecution of municipal work would enable him to take a short vacation. He even suggested that, owing to the prospect of construction of some important work, which was to be soon put under contract, it would be well for the city to grant him a leave of absence long enough to enable him to visit other cities where work of a similar character was then under construction; such an inspection would afford him the opportunity to criticise the methods of construction of other engineers, and possibly to give to the city, in its forthcoming work, the benefit of the experience thus acquired.

The preposterous suggestion of a pleasure trip to be taken by a public officer *at his own expense*, while under salary, was evidently too much for the equanimity of the austere City Fathers. Was it not somewhat remarkable that their engineer, appointed or elected for his ability to design and build all their municipal work, should want to procure ideas from others and to spend in such an unheard-of manner the time which should be devoted to the work that he was paid to do? Other remarks from both sides followed, showing that there was very little prospect of an agreement, when the timely suggestion that the intended visit could be made with more profit to all concerned if the engineer was to go on the same trip as the companion and professional adviser of a Committee of the City Government turned the course of the argument, and the great men left, promising to think of the subject.

This little incident reminds us of the fact that very few of our engineers have any chance to acquire, *de visu*, a knowledge of engineering works in other parts of the United States (not to speak of foreign countries). Even the information which they can obtain from written descriptions of distant works is very incomplete. Whether the paucity of adequate descriptions of works of construction is due to the lack of leisure on the part of the superintending engineers, or to the reluctance of some to publish the methods of their practice, it must be admitted that the knowledge disseminated by scientific periodicals and by other engineering papers covers only a limited part of the field of modern American practice.

An illustration of this statement can be found in the diversity of practice which obtains in different districts for the construction of public and other works. Each method has probably its good points, and if engineers had more opportunity to compare the efficiency and cost of all of them, and to combine their best features, they would be able to design and construct better work, possibly for less money. This remark does not apply with so much force to such mechanical and other structures as are generally produced at a limited number of central points, to be distributed all over the country, but they cover many engineering works which originate, and are designed, at the place where

they are to be constructed by engineers residing in the same locality.

There have been lately some successful efforts made to bring together the members of various professional associations for the purpose of discussing questions of interest and of comparing notes; and the result of their stated gatherings has been to secure greater uniformity of practice in various branches of mechanical construction and engineering generally, by giving their members an opportunity to exchange ideas and to visit together works of interest. They have also served to cultivate a better feeling among the members generally, but more individual intercourse between engineers is needed, especially at this time of universal activity in the construction of engineering works of all descriptions.

Municipal and other corporations, when desirous to engage in the construction of works of importance, should favor the practice of giving to their professional advisers ample opportunity to study, by actual inspection, the methods of work used by others, and we firmly believe that this course, if judiciously followed, would result in substantial benefit to the profession and to the community.

POLLUTION OF THE PASSAIC.

FOR the last ten years we have been satisfied that the inhabitants of Newark and Jersey City were at times drinking diluted sewage, and that sooner or later the evil results would become so manifest that public opinion would imperatively demand a change.

Occasionally there have been little spasms of disgust in the form of letters to the press from some citizen pointing out the numerous sources of pollution of the Passaic River, which have been followed by reports, with chemical analyses, showing that the pollution was not so very great; notes on the self-purifying power of running streams, and tables of vital statistics to prove that the health of these cities was fairly good or even excellent.

The reports of expert engineers as to what should be done to improve the water-supply have led to no very practical results, and it seemed probable that a cholera epidemic would be necessary to bring about the required improvement. The *Sunday Eagle*, of Jersey City, has now taken the matter up, and its article is republished in pamphlet form, with a number of appendices, including a report from Professor Leeds, extracts from reports of the State Board of Health and the State Geologist, some comparative vital statistics, and a map indicating the sources of pollution of the river and their relations to the intake for the water-supply of Jersey City. The proof that the Passaic water which is pumped through the water-works of Jersey City is polluted with sewage, factory refuse, dead animals, etc., is given *usque ad nauseam*, but all this is an old story.

The newest part of the pamphlet is that which gives a comparison of the death-rates of Jersey City and of Hoboken for several years before and after 1882, in which year Hoboken changed her water-supply from Passaic River water furnished by Jersey City to Hackensack River water. Before this change was made the death-rates, and particularly those from zymotic disease, were higher in Hoboken than in Jersey City, as will be seen by the following table:

Total death rate per 1,000 of Population.			Death rate per 1,000 from Zymotic Diseases.	
Year.	Jersey City.	Hoboken.	Jersey City.	Hoboken.
1875	25.9	30.5	No report.	No report.
1876	26.8	30.7	"	"
1877	22.3	26.4	"	"
1878	20.7	25.0	"	"
1879	20.3	22.4	"	"
1880	22.4	23.7	5.9	6.8
1881	26.2	20.9	8.0	10.0
Averages	23.5	26.9	6.9	8.4

After the change was made the figures were as follows :

1882	26.0	24.9	7.7	7.7
1883	21.9	21.3	5.2	4.5
1884	21.7	21.1	5.2	3.9
1885	22.8	23.6	5.9	5.4
1886	22.5	22.4	5.5	5.4
Averages	22.9	22.6	5.9	5.4

The improvement in the health of Hoboken does not seem attributable to any other cause than the improvement of the water-supply, and what was good for Hoboken would, undoubtedly, be good for Jersey City.

during a discussion at the Society of Arts, that for the future the society would award its certificates, etc., to the makers and not the sellers of goods. This is a step in the right direction.

Speaking in the discussion of a paper on the new drainage works at the Houses of Parliament, read by Mr. John Phillips, C. E., before the Institute of British Architects, Sir Robert Rawlinson briefly summarized his views of an ideal system of drainage, practicable where a place could be dealt with *de novo*. Every valley line and stream should be rigidly kept as a surface-water channel and outlet; the sewage proper should be intercepted from the valley lines and carried to an intercepting sewer.

An insurance association of a novel character is being established in manufacturing centres in France, and will probably be imitated in other industrial countries. A central establishment, with a complement of medical men and apparatus, is in telephonic communication with the principals of the factories subscribing. On the receipt of intimation from any such factory that an accident has occurred, the

At each rectangle an opening was provided to allow of the raising or lowering of "legs," and in the centre other openings permitted the lowering of the cylinders. When a firm working position was required, the pontoons with the legs standing above the level of the deck, was floated out to the spot, the legs lowered to the bed of the river, and the deck raised on the legs by hydraulic power, and supported thereon by pins. Valves were provided, permitting the ballasting of the pontoons with water, to prevent them floating their legs on a high tide.

SAFETY-VALVE.

OUR SPECIAL ILLUSTRATION.

STAIRCASE, Examination Schools, Oxford, England. T. G. Jackson, London, architect.

OUR VIGNETTE ILLUSTRATIONS.

RESIDENCE OF MR. A. J. HEMPHILL, COMO, MONMOUTH COUNTY, N. J.

THE subject of one of our vignette illustrations this week is the residence of Mr. A. J. Hemphill at Como, Monmouth County, N. J.



HOUSE OF A. J. HEMPHILL, COMO, N. J.—COPE & STEWARDSON, ARCHITECTS, PHILADELPHIA.

It is fairly probable that the pollution of her water-supply costs Jersey City from three to four hundred deaths, and from five to six hundred constantly sick each year.

It is to be hoped that the effort made by the *Sunday Eagle* to have a change made in the water-supply will be successful, and that a skilled engineer will soon be set to work.

OUR BRITISH CORRESPONDENCE.

Restricting the Award of Exhibit Medals—Ideal Drainage—Accident Insurance for Factory Employees—The Tay Bridge.

LONDON, June 1, 1887.

It has long been customary in exhibitions, etc., for jurors to award medals to the exhibitors of articles, irrespective of the fact that the firm or individual exhibiting is neither inventor nor manufacturer. I know of a case where three distinct firms hold the certificate of a certain institute for the same trap. It was recently announced

doctors attend and administer such first aid as is needful. In the event of the accident being slight and necessitating only home attention, the association carries it through to the recovery of the patient. If a hospital case, the association duties cease when the patient is taken to the hospital. The scheme is, of course, established in the interests of employers, not of workmen.

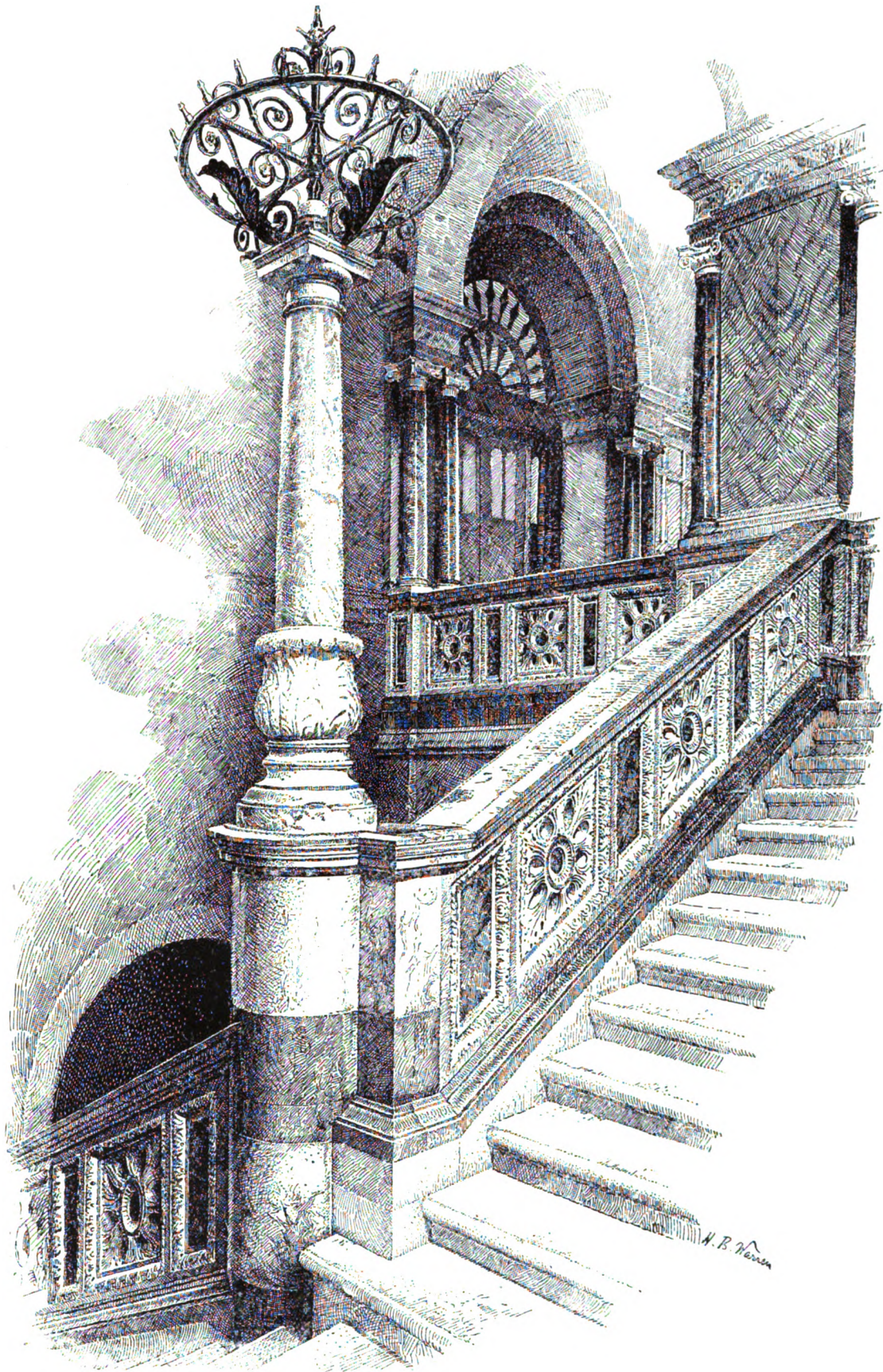
The Tay Bridge approaches completion, and it is hoped by the North British Railway that it will be ready for opening early in July. Certain preliminary tests were made last week when six locomotives and tenders were run on to the centre span of the bridge side by side on the two lines of metals. The centre span is 245 feet, the weight of the locomotives 430 tons, and the maximum deflection 1 3/4 inches. The total length of the bridge is rather over two miles and consists of 85 spans of 50 to 245 feet; clearway between water-line and centre span, 79 feet. For sinking the cylinders of the bridge specially designed pontoons, constructed of tanks, were utilized by Messrs. D. Arrol & Co., of Glasgow, the builders. The dimensions of these floats were 81x66x7 feet, and they carried all manner of apparatus in the shape of cranes, boiler and engines, etc.

Monmouth County, N. J. It is a frame structure, shingled, on brick cellar and foundation. The interior is finished in white pine and oak. The total cost was \$4,088. Messrs. Cope & Stewardson, 212 South Third Street, Philadelphia, were the architects.

TWO WINDMILLS.

We illustrate this week two windmills designed respectively by Architects Edward Lowery Woodruff, of Tompkinsville, N. Y., and H. Edwards Ficken, of New York City. We are indebted to Mr. A. J. Corcoran, of No. 76 John Street, New York, for the use of the photographs from which the drawings were made.

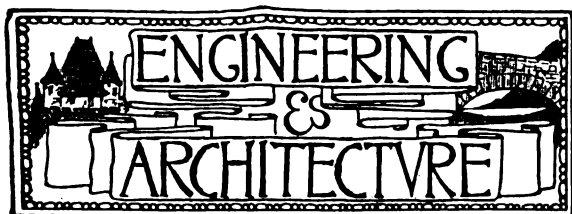
A NEWSPAPER controversy has recently been going on in California between Mr. Andrew Rosewater, C. E., of Omaha, and Colonel George E. Waring, Jr., of Newport, R. I., over novelty of the separate system of sewerage and value of manholes on small pipe sewers.



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

STAIRCASE, EXAMINATION SCHOOLS, OXFORD, ENGLAND.

T. G. JACKSON, ARCHITECT.



THE BOSTON METER TEST.

By the courtesy of the Boston Meter Commission, the members of the Boston Society of Civil Engineers, and other gentlemen interested in the subject, were given an opportunity, on the afternoon of Saturday, June 11, to see the apparatus devised by the commission, and to learn from the chairman and his colleagues the method which is followed in carrying out the purposes for which the commission was created. The rooms occupied by the commission are at the southerly end of the Mechanics' Building on Huntington Avenue, in the basement. The main room is perhaps seventy feet long and less than half as wide; is divided longitudinally by a railing about waist high, and is well-lighted by windows, which occupy nearly the whole of the upper half of the south wall.

The testing-benches, scales, tanks, supply and waste pipes are all on the south side of the railing, and the other

any plans when made are submitted to the Water Board for approval. The board expressed a wish, too, that the tests should be as public as might be found possible without interfering with the trustworthiness and accuracy of the tests. In conformity with this wish the railing is so placed as to allow everybody to see and hear everything and prevent any outsider from touching the apparatus.

Each meter is subjected in turn to the following line of treatment. It is first tested for accuracy—that is, before any work is put upon it. It is then subjected to a durability test by putting through it, in a constant stream, as much water as would under ordinary conditions be put through such a meter in one year, and this will require about twenty days of constant running. Then the meter is to be subjected to intermittent use for a length of time not exactly stated, and finally is to be put through the same tests for accuracy that were made upon the new meter. After the second test for accuracy, the meters are to be taken apart and carefully examined, the proportions of the parts are to be studied and any evident opportunities for improvement noted.

In detail the tests for accuracy and retardation of flow are quite elaborate.

A gauge is placed on the 6-inch main just as it enters the testing-room, another midway of its length, a third at its end near the testing-tank, and small gauges are placed

MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. VI.

(Continued from Vol. XV., page 516.)

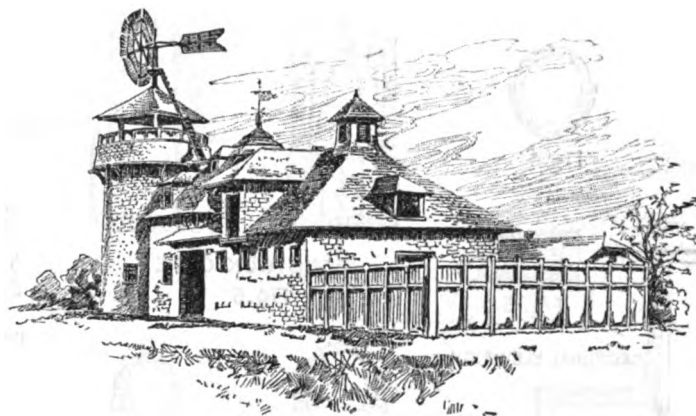
THE Boston intercepting sewers, so far as now constructed, pass along the shores of the South Boston and Boston peninsulas, which they will finally completely girdle, as shown upon the map published in a recent number.

The junctions of the branches of the intercepting sewers with the main are bell-mouthed in form, so that the axes of the two sewers meet by curves tangent to each other; this arrangement occasions the least possible disturbance to the current. Sections of one of these bell-mouthed chambers are given on the next plate. Near each of these junctions a "penstock" or stop-gate is constructed, by closing which the main sewer can be entirely emptied for a while for inspection. When so closed the intercepting sewer would discharge through the old mouths or outlets near where its laterals are intercepted. These outlets are all retained for such emergencies as well as for storm-water overflow under control, and are protected against tide-water by self-acting valve-gates.

The inclination throughout nearly all these intercepting sewers is 1 in 2,000. This slope will, it is expected, afford



EDWARD LOWERY WOODRUFF, ARCHITECT.



H. EDWARDS FICKEN, ARCHITECT.

TWO WINDMILLS.

half of the room is open and is reserved for spectators. Huntington Avenue carries a 16-inch main, and from this a 6-inch pipe is brought into the testing-room, and runs along directly under the testing-bench. This 6-inch main is about 200 feet in length, and is tapped just after it enters the testing-room by two service-pipes, one an inch and the other three-quarters of an inch in diameter. These service-pipes are carried along under the testing-bench just above and parallel with the 6-inch main to the farther end of the room, where are located the scales and tanks. By this arrangement two services 55 feet in length are obtained, and the average conditions met in practice are in this particular fairly represented. In all the tests for accuracy under the ordinary pressure these service-pipes are used. When a meter is to be tested under different heads, other service-pipes supply water to tanks located on the different floors, and the meters are supplied from the tanks.

For durability tests, sixteen 1-inch taps are connected with the 6-inch main under the testing-bench, and by means of lead-pipe connections a row of sixteen meters can be placed upon the testing-bench and allowed to receive and discharge all the water which they are capable of passing. A drain-pipe of ample size with open branches receives the discharge, one branch for each meter. The chairman of the commission stated that the Water Board of Boston had given no minute instructions as to the method of testing, but had left nearly everything for the commission to arrange for itself, but

at the inlet and outlet of the meter. The commission has chosen the method of measuring out given quantities of water by weight and reading the meter as closely as may be, and by a simple but ingenious electrical arrangement the flow of water is stopped on the instant that the scale tips at the required weight. By an arrangement of tanks and pipes the meters can be made to discharge under back-pressure varying from zero to fifty-one feet.

To illustrate: 10 cubic feet were discharged by a meter through a $\frac{3}{4}$ -inch open pipe into the tank in 3 minutes 30 seconds; with back-pressure of 8 feet in 4 minutes 8 seconds; with back-pressure of 22 feet in 4 minutes 40 seconds; with back-pressure of 36 feet in 5 minutes 32 seconds; with back-pressure 51 feet in 6 minutes 50 seconds; and 10 cubic feet were discharged through $\frac{1}{2}$ -inch opening in 4 minutes 6 seconds; through $\frac{3}{8}$ -inch opening in 9 minutes 58 seconds; through $\frac{1}{4}$ -inch opening in 23 minutes 35 seconds; and through $\frac{1}{8}$ -inch opening in 3 hours and 40 minutes.

The initial pressure under which the meters work can, by the use of tanks, be put at 84, 55, 40, 26, or 8 feet head, and it is proposed by the use of a steam-pump to provide an initial pressure of 200 pounds per square inch for all meters that will stand it.

The commission consists of L. Fred Rice, C. E., chairman, Mr. Charles Carr, a mechanical engineer, and Mr. Leow, an inventor and mechanician.

a velocity of flow that will prevent the deposit of sewage sludge, though not always preventing deposits of sand or road detritus. To provide for this emergency, flushing gates have been built into the large sewers at intervals of about half a mile. Their construction is illustrated by Fig. 15 of Plate IV.

When not in use the gate stands above the sewer in the manhole. The lower part is hinged, and is kept vertical by bolts. When used it is lowered on to its seat and allowed to remain there till the sewage has accumulated to its top. The bolts are then drawn, allowing it to tilt as soon as it is raised from its seat, when the impounded sewage rushes forward. The weight of the gate is counterpoised as shown.

In order to govern at all times the flow of rain-water into the intercepting sewers and prevent an unnecessary quantity from flowing to the pumps in times of storm, the junctions of various laterals with the intercepting sewers are provided with automatic regulators, adjusted to the circumstances of the separate cases.

In the case of the South Boston intercepting sewers, the whole district is so high that the rain-water can be discharged with impunity into the harbor without flooding cellars. The regulating apparatus is therefore in this case applied in the intercepting sewer itself just below its last lateral branch at Kemp Street.

It is illustrated by Fig. 9, Plate IV, and is described by Mr. Clarke as follows: "The apparatus is very simple and consists of stop-planks, closing the sewer from its top

down to about the ordinary dry-weather flow-line, the sewer below the planks being lined with a cast-iron gate-frame or seat, curved to fit the invert, and also vertically to correspond with the curve of motion of a cast-iron valve which plays up and down in front of it. The valve is held by two cast-iron levers, pivoted by a 3-inch wrought-iron shaft in two bearings, the other ends of the lever being connected by vertical arms to a 3-inch square bar. To the ends of this bar are fastened two boiler-plate floats, placed in wells on either side of the sewer. To avoid disturbance to the motion of the floats by waves caused by a rush of sewage under the valve, water is brought to the wells through a 5-inch pipe, as shown, from a point fifty feet below the regulator.

The connection between the valves and the floats can be so adjusted that the former will begin to close when the surface of the sewage in the sewer has reached any desired height. As the floats rise the valve descends until the opening below it is just sufficient to let enough sewage pass to maintain the allowed depth of flow in the sewer. Should the amount of rain-water from low districts, reaching the main sewer through other intercepting sewers, exceed the capacity of the pumps to control it, the main sewer fills and its sewage backs up into the South Boston sewer, and still further raises the floats. The opening under the stop-planks is thus entirely closed, and all of the common sewers above discharge at their old outlets, and continue to do so until the amount of water reaching the pumps can be controlled by them."

South Boston, which are so low that insufficient head-room was afforded for the usual section. These tracks are here depressed some feet below tide-water level, in order to pass under those of the Old Colony Railroad, and are drained by special pumps maintained by the Railroad Company.

The diameters and cost of various sections of these sewers, under different conditions, is thus given by Mr. Clarke:

Size.	Thickness of Walls.	Average Depth below Surface.	Cost per Foot.	Material in which it is Constructed.
6 ft.	12"	20 ft.	\$12.68	Clay and sand.
5' 6" x 4' 9"	8"	24 ft.	13.35 to 16.85	See Fig. 10.
5' 7"	.....	24 ft.	26.16	Piles used in mud.
4' 6" x 4' 8"	.....	21 ft.	11.97	Clay.
4' x 4' 6"	.....	.....	10.10	.....

(TO BE CONTINUED.)

THE FUTURE FOR ENGINEERS.

IN his inaugural address as President of the Society of Engineers, Professor Henry Robinson refers to a prevailing fear that opportunities for professional work are falling off, and that the future for engineers is not encouraging, saying that he does not believe there is any ground for such gloomy views. He says: "Having myself, during the last twenty-five years, passed through three periods of profound depression in trade, entailing a like feeling of anxiety and doubt as to the future of professional work, I have a vivid recollection that these dark periods were followed by times of great prosperity. The interval between

BUILDING CONSTRUCTION DETAILS.

No. V.

BALLOON FRAMES.

(Continued from Vol. XV., page 544.)

THE old adage that necessity is the mother of invention has been illustrated in many ways in the various building operations which have been carried on in the Western States. The greater portion of our mechanical and building methods have naturally been derived more or less directly from English ideas, and in the East these ideas have always prevailed. In the West, however—and the term West includes the country even as near at hand as western New York—lack of time, a desire to build as cheaply and with as few mechanical appliances as possible, and doubtless a lack of skill on the part of the mechanics available for ordinary building operations, have led to certain innovations of the Old-World usages. In the West the great demand has always been for small, inexpensive houses, and the amount of material and labor involved in their construction has been reduced to the lowest possible degree by the adoption of what has been very suggestively termed the balloon frame, a system which differs considerably from the ordinary post and girder frame, while possessing many points in common with it, and which is worthy of a little serious study and comparison with the older method.

Any man who knows how to use a hammer, a square, and a saw can call himself enough of a carpenter to build a house with a balloon-frame, for those are the only tools used. Figure 1 is a diagram sufficiently extensive to illustrate this construction. It must be remembered that in the West, lumber is usually obtained from a yard, and only regular sizes and dimensions can be had. The ordinary foundation-walls are of brick, eight inches thick. On this is laid a 2x8-inch timber as a sill, the corners being halved and spiked together. The studs are cut a uniform length, and are set up on the sill, being simply toe-nailed thereto, with no tenoning or framing whatever. The studs are all 2x4 inches. They are doubled at all corners and each side of all openings, but none of the openings are framed, the studs being commonly spaced along the whole wall, sixteen inches on centres, without regard to doors or windows, the opening being cut out and the side studs doubled after the floors are all laid. A 2x4-inch plate is nailed on the top of the studs as a tie and to support the rafters and ceiling beams, which are more often arranged as shown by the figure, though in some cases where attic space is not required the rafters rest on the 2x4 plate between the ceiling beams, to which they are nailed. In the present instance the ends of the ceiling beams are cut down two inches and a 1x6 board nailed across the tops of the beams to support the rafters.

The floor-beams, usually 2x10 inches for spans of less than twenty feet, are spaced to correspond with the studs. This is an essential element of the construction, and all chimneys, stairs, etc., inside of the house must conform thereto. The first-floor beams rest directly upon the 2x8 sill and are nailed twice against the sides of the studs. The flooring is carried out between the studs, and in the better houses it is customary to fill in over the flooring between the studs with three courses of brick to keep rats from rising in the wall. To support the second-floor beams a 1x6-inch strip, generally known as a ribbon, is let in flush with the inner face of the studs and the floor-beams are notched one inch over this, besides being nailed to the studs. The construction at the ceiling has been previously explained. The rafters are usually no more than 2x6 inches and are spaced twenty inches on centres across the entire roof. There is no doubling of the rafters in any case except for weak valleys, and as the rafters are laid out so as to butt exactly against each other, the ridge is dispensed with, the heads being nailed together, while the feet are toe-nailed to the plate or to the 1x6 band. And, finally, all roofs and walls are covered with 3/4-inch boarding, nailed twice to each stud and rafter.

If construction is to be considered as a scientific operation involving careful planning and exact workmanship, the balloon frame becomes mere ignorant child's play unworthy of notice. But if the proof of the pudding is in the eating; if the end justifies the means; if it does not matter how a building is constructed, so long as it is light, strong, and durable, then the balloon frame is one of the neatest of adaptations to necessity and circumstances, and deserves a better name than is usually given to it. That it does produce a stiff, staunch building cannot be denied, for nowhere do the winds have the force and the velocity they acquire on the Western prairies, and yet the average

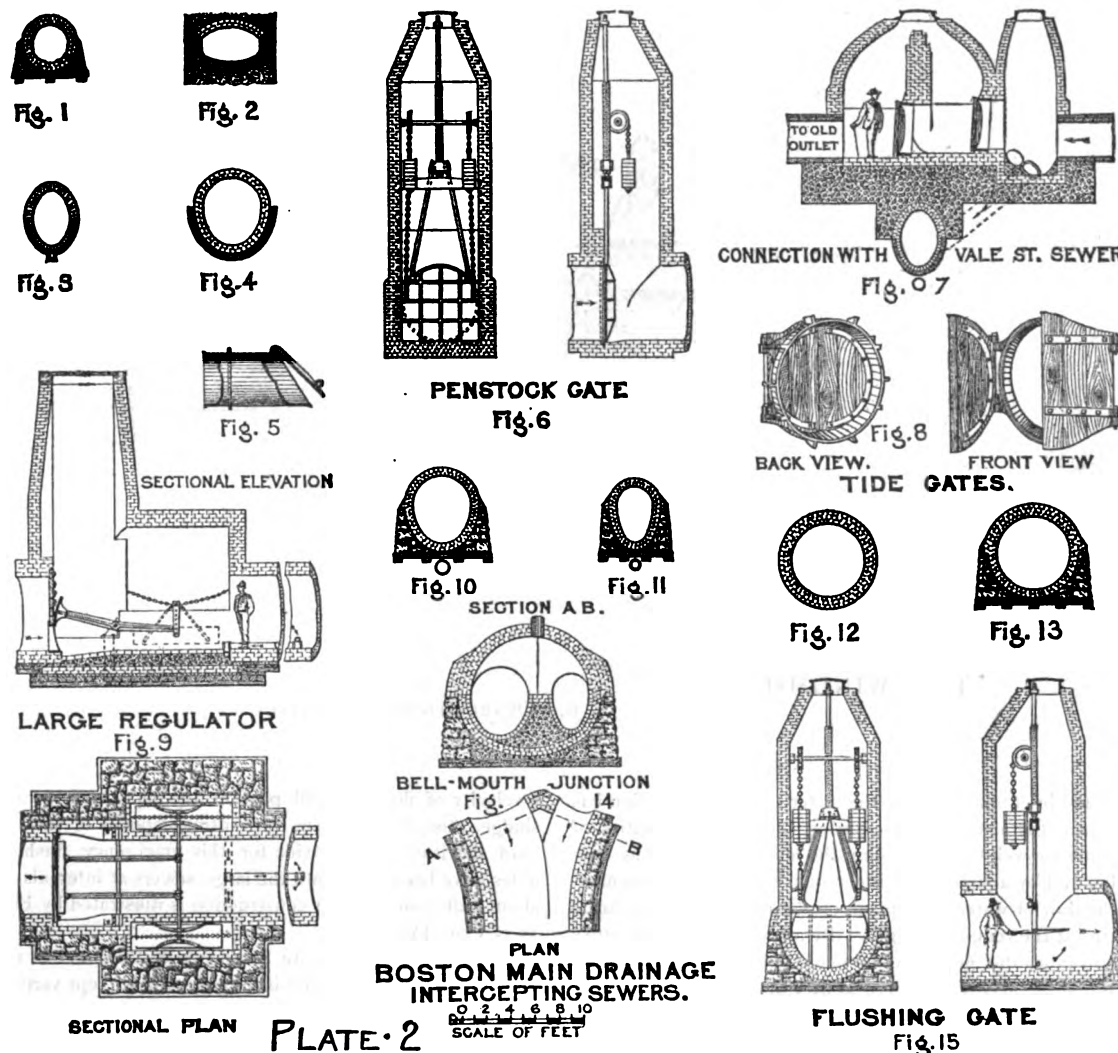


PLATE 2

When no regulation was needed to govern the amount of water to be received from a lateral sewer the connection was made as shown in Fig. 7, which illustrates the junction of Vale Street sewer as a type of this kind. The section of the intercepting sewer appears below, and the lateral sewer, with its manholes and tide-gates, above.

Figure 5 shows the short piece of iron pipe built into a sump in the bottom of the lateral sewer, with a cast-iron flap-valve, generally kept open. One or more of these was used, as occasion demanded, to conduct the water from the bottom of the lateral to the interceptor.

The tide-gates are hinged to cast-iron rings, (see Fig. 8,) built into the brick-work. The gates are inclined so as to be self-closing, and have rubber bearings to insure tightness. Figures 1, 2, 3, 4, 10, 11, 12, and 13 illustrate the various forms and methods adopted in constructing the intercepting-sewers, according to the circumstances of the case. The form shown by Fig. 2 was used only where passing under the tracks of the N. Y. & N. E. R. R. in

the two periods lead many to abandon the profession, either from inability to wait for better times, or from an erroneous notion that those better times would never come. My own experience has led me to think that probably most of those who discarded their profession in this way were really not fitted for it, or had no real love for it."

The cause of failure in the profession, he thinks, is usually defective training. "Many youths are sent almost direct from school into workshops, whilst, on the other hand, many pursue their theoretical studies apart from opportunities of observing the practical application of their knowledge. In both cases an important factor in the formation of an engineering training is wanting. In the former the youth may become a skillful mechanic, but will lack breadth of knowledge to fit him for a profession which has pre eminently to deal with large subjects extending over a wide range of thought. In the latter the youth is wanting in the leaven of practical knowledge. I do not consider it possible in any educational establishment to impart to and impress upon the mind the results of the matured experience of actual practice, although a considerable approach to it can be accomplished."

Western house is about as free from jars or bulged walls as the average dwelling about New York or Boston. The whole secret of the stiffness of the balloon frame is in the thorough boarding of roofs, walls, and floors, tying the whole so effectually that there is no chance to give in any direction. Nails may not be as sure and lasting factors of resistance as wooden tenons, but they are much cheaper, and where time and money have to be considered as carefully as they are in the West, the balloon frame can hardly be condemned on any just grounds.

For purposes of comparison, a diagram is given herewith of the ordinary post and girder construction. Figure 2 will be of interest to those readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD who are more familiar with the other method. It will be seen that whereas in the balloon frame each stud bears its share of the burden, and is an essential element of the construction, with the post and girder system the sill, the corner-posts, the girts, and the plate constitute the frame by themselves, being braced firmly by the diagonal pieces, and made of sufficient strength to alone sustain any ordinary strain that would act upon the wall, the 2x4 studs acting only as a filling to the skeleton. The stiffening powers of the floor, wall, and roof boardings are not considered as elements of strength, or at least are not relied upon, and all of the principal pieces of timber are tenoned together. There can be no doubt that this is a much more scientific, workmanlike and enduring construction than the balloon frame, and should be used in all cases for houses of any size, but

EXAMINATION OF THE ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.

THE third examination carried out under the auspices of this association took place on Friday and Saturday, the 22d and 23d of April, at the Institution of Civil Engineers, Great George Street, Westminster, on which occasion nineteen candidates presented themselves for examination.

The written and graphic portion of the examination occupied the first day. The *viva voce* being taken on the second.

The examiners were: Mr. J. Lobley, M. Inst. C. E. (President of the Association), Borough Engineer, Hanley; Mr. W. G. Laws, M. Inst. C. E., City Engineer, Newcastle-on-Tyne; Mr. E. B. Ellice-Clark, M. Inst. C. E., County Surveyor, Sussex (West); Mr. H. P. Boulnois, M. Inst. C. E., Borough Engineer, Portsmouth; Mr. Lewis Angell, M. Inst. C. E., Borough Engineer, West Ham.

The following are the papers set at this examination: **SUBJECT:—Engineering as Applied to Municipal Work—W. George Laws, M. I. C. E., Examiner.**

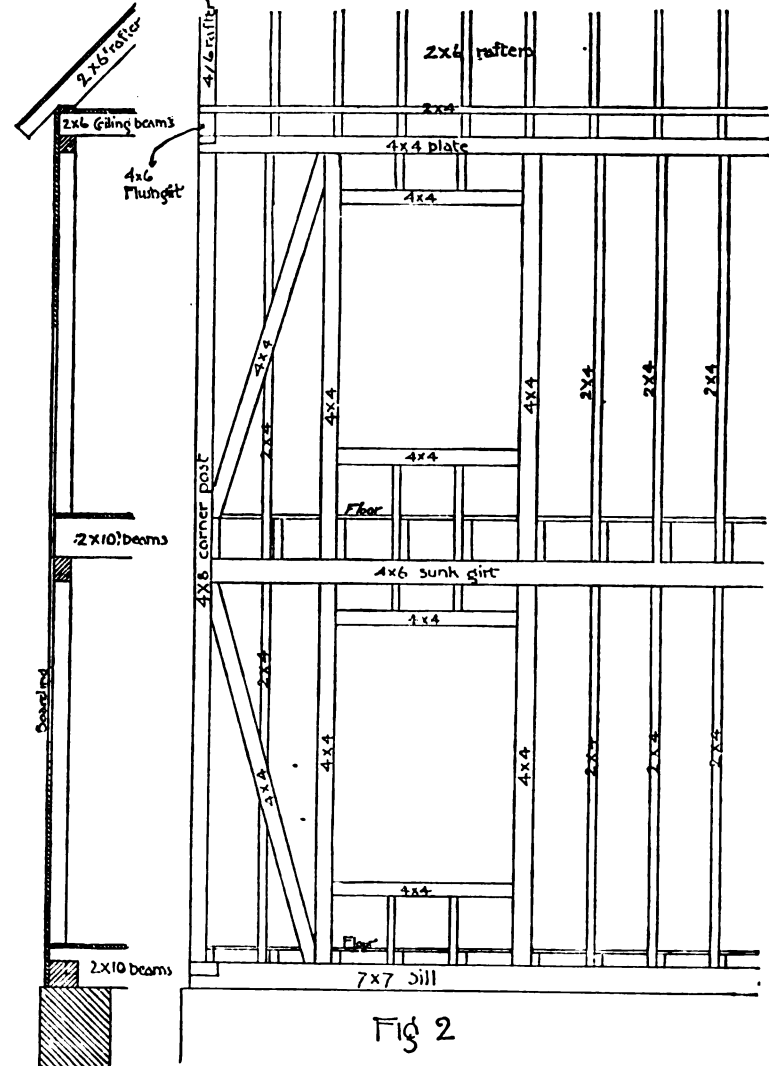
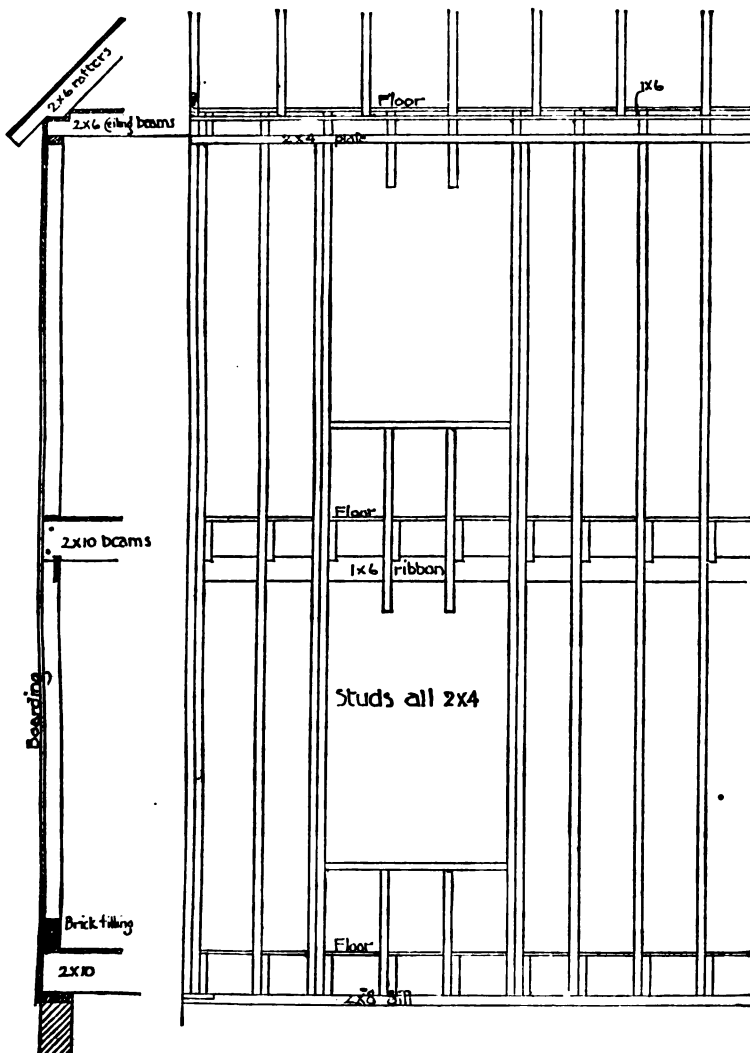
1. How are the lines of a chain survey fixed in position, and how is the correctness of the work tested? What is meant by "tying" the lines? Give a sketch.
2. How would you find the relative levels of a sloping field, say for laying it out for streets? What instruments are used, and how?

1. Under what conditions would you construct inverted arches in a building—and what purpose do they serve?
2. Sketch some different forms of dowels used in masonry. Show the position of a kneestone in a wall.
3. Under what conditions would you lay masonry or concrete blocks in diagonal bond?
4. State Tredgold's, or other rule, with diagram, for proportioning the various parts of a scarf [having regard to the strength of different timbers] to resist tensional, compressional, or shearing force respectively.
5. What considerations determine the form of truss or principal for a roof of a given span?
6. Sketch the principal of a roof, not iron, for a span of 26 feet, where a tie-beam is inadmissible.
7. What do you consider the best method of forming a fire-proof floor for a warehouse? State the advantages and disadvantages of arched floors.
8. What is meant by sheet-lead "crawling," and under what conditions will this happen?
9. Write a short specification for flat roof to be covered with zinc, giving such sketches as you consider necessary.

SUBJECT:—Sanitary Science.—Lewis Angell, M. Inst. C. E., Fellow King's Coll., London, Examiner.

1. What are the component parts of—
(a) Pure Atmospheric Air?
(b) Pure Water?

What are the usual sources of contamination in a dwelling-house?



for cottages, stables, and ordinary light constructions, it is a question whether the advantages of a post and girder frame would be commensurate with greater cost as compared with the Western method.

It may be of interest to consider just how much more expensive one method is than the other. A section of wall framed like Fig. 1 contains 171 feet of lumber, and would require about 133 nailings. The only fitting would be in connection with the two ribbons. The portion of frame shown by Fig. 2 would contain 283 feet of lumber, have practically no nailings, but each beam in the first floor has to be gained into the sill, and there would be at least fourteen mortises and tenons to cut and fit. The diagonal braces and the window heads would offset the fittings of the ribbons in the balloon frame. We will assume the rafters and the beams equivalent in each case. The post and girder frame requires more care in setting, and we can only approximate the difference in labor, probably not over thirty per cent. more than the balloon frame. Figure 2 requires, as we see, quite sixty-six per cent. more lumber than Fig. 1, and the difference would actually be much greater for the entire house, for timbers as light as 2x6 for ceiling beams and rafters would seldom be used in the East, and 20 inches would be considered too wide a spacing for the rafters. Whence it is fair to assume that the balloon frame can be put up for one-half the cost of the ordinary post and girder construction.

3. What is a syphon, and how may it be used in carrying water from one side of a dam to the other? What conditions are essential to its action? Give an instance you know of its use in main drainage.

4. What is meant by "Hydraulic Mean Depth," and how is it calculated? What is the H. M. D. of a trough 12 inches square running full?

5. Describe the mode of "laying" and jointing an ordinary street sewer-pipe, and the use of "boning-rods" in securing uniform fall therein.

6. Sketch and describe an approved manhole and its proper position and uses in a system of sewers.

7. When are brick sewers to be preferred to pipes, and what is their best shape? Sketch section of and specify very briefly for a length of brick sewer.

8. Describe and illustrate the mode of forming a reservoir dam, showing how it is made water-tight, and the precautions to be taken against leakage, and damage by overflow.

9. Calculate the strain per square inch on the metal of a pipe four inches diameter, and one-half inch thick, under a head of 300 feet of water-pressure.

10. Mention some of the chief systems of wood paving. Specify briefly for one of them, and state where it is applicable, and why.

SUBJECT:—Building Construction, etc.—E. B. Ellice-Clark, M. I. C. E., H. P. Boulnois, M. I. C. E., Examiners.

2. How many cubic feet should be allowed for each adult in a sleeping-room?

3. What natural conditions and structural precautions are necessary to secure a healthy site for a dwelling?

4. Sketch a section of a house of three stories, showing—
(a) A sink on ground floor.
(b) Water-closet and bath on first floor.
(c) Water-closet on third floor.

and show, distinctly, the water-tanks and entire method of drainage, trapping, sewer connection, and ventilation.

5. What proportion in sectional area should the ventilating-pipe above a water-closet bear to the soil-pipe below?

6. Describe a practical test to discover any hidden defects in a house-drain as to jointing, trapping, etc.?

7. For what quantity of rainfall in 24 hours is it usual to provide in a main sewer, and how many cubic feet per head of the population would you provide for in a water-carried system of sewerage?

8. State the advantages and disadvantages of a duplicate system of drainage for the separation of rainfall from the sewage?

9. State, generally, what are the methods adopted for the purification of sewage at the outfall, and describe some one chemical process, its mode of operation and results.

SUBJECT:—Public Health Acts and Rivers Pollution Acts.—Joseph Lobley, M. Inst. C. E., Examiner.
This examination was confined to a knowledge of these acts.

IRRIGATION REGULATION IN COLORADO.

THE third biennial report of the State Engineer of Colorado, which deals largely with irrigation problems, shows very forcibly the great importance of State control to regulate the use of water and prevent its waste. The State has adopted an excellent system of laws, and the engineer refers with pride to the favorable interest manifested towards it by other States, and even by the Parliament of Australia. Like all new laws, these have had to be put in operation in opposition to the prejudices and selfishness of those who had been using water wastefully, and without law.

The laws require proper measuring flumes and head-gates to all ditches, but these provisions are not always obeyed, and the engineer has not the authority to *oblige* their introduction.

The old method of measurement by the inch has been introduced in many of the decrees and leases of water right, and is still the legal measure. On account of its uncertainty it is desirable to have the cubic foot as the standard. The equivalent to this is stated by one Commissioner as "38 $\frac{1}{8}$ statutory inches." Among other recommendations, Mr. Nettleton desires that police power be given the Commissioners to arrest all persons guilty of changing head-gates or otherwise violating the laws; also, for protection to the Commissioners while performing their duties; also requiring all appropriators of water to prove up their rights and obtain a judicial decree defining their rights. One difficulty experienced, has been the lack of a competent authority to decide questions as between various drainage districts, and a law is asked creating a board of water commissioners for this purpose.

Another requirement constantly mentioned in the Commissioners' report is a self-registering of the heights of water at the intakes to the canals, for the purpose of giving a continuous record of the flow. By this means it is hoped to gain more exact data for the determination of the vexed question of the "duty" of water.

The various Commissioners report a decided increase in duty since the opening of the ditches as an effect of "seepage" through the soil. In the Cache la Poudre district for the season of 1886, the duty "was about three times as large as the estimate heretofore generally accepted, the average for May to August, inclusive, in District No. 3, 193 acres per foot discharged per second; 200 acres are mentioned as not unusual in Utah, and still more in California.

The year 1886 was one of great scarcity of water, the whole amount discharged in the irrigating season being less than that for the month of June, 1884. For that reason the commissioners were called upon to adjudicate upon the amount flowing to each taker, adjust the head-gates, etc., in many cases, and toward the close of the season the supply was reduced to that for domestic use only.

In extreme cases, this was given on alternate days only, so as to eke out the supply.

As all this has to be done with a due regard to priority of rights, it will be seen that the duties of a commissioner are often of a very delicate nature, and the pay vouchsafed (\$5 per day only) for the short time engaged is not, it seems to us, sufficient for such services. The office ought certainly to be a permanent one, so that the occupants may become skilled in their duties, and their services more valuable on account of experience gained.

The question of seepage is a very important one, of which an interesting example was given some time since in our columns, and some ditches have been built which depend entirely upon this for a supply.

Near the close of this interesting report is a discussion of the growth of husbandry in the State. The earlier settlers planted only wheat, but now other grains and small fruits and vegetables are cultivated extensively, and the introduction of vineyards and orchards is rapidly progressing. By a careful attention to the varieties of fruit introduced, the apple has been successfully cultivated up to heights of 8,000 feet, and pear, plum, and cherry trees are in bearing up to 6,500 feet in La Plata County.

A great deal has been said about raising good crops *without* irrigation. On this point we quite agree with a quotation given from a private letter. "You may add as an axiom, that no crops of grain are raised anywhere in the State of California with a less rainfall than ten inches, and that *good crops* are only the result of twelve to fourteen inches rainfall and upward. We have not yet discovered

the secret of making vegetation grow in dry land without irrigation. Since heavy rainfalls have made grain-growing possible almost anywhere in the arid region, the impression has been spread abroad that irrigation is unnecessary, but a few normal seasons will speedily correct this impression."

The report takes up the question of reservoirs as a means of storing water in times of scarcity; and points it out as worthy of encouragement by the State. One of the commissioners discusses briefly the question of the diminution in flow as affected by the general destruction of the trees, but the statistics are too meagre to base any certain conclusions upon. It cannot be doubted that the effect of the wholesale deforesting of the mountains will be very disastrous to the whole country.

RISE OF WATERS OF THE NILE.

THE following table, drawn up from a report of Colonel Moncrieff, resumes the observations of more than a century and will show the enormous variations which take place in the rise of the waters. In the period of 126 years the Nile, at Cairo, has been marked:

5 times at.....	25 pies or.....	m.
24	24	20.12
24	24	19.58
28	24	19.04
21	22	18.50
19	21	18.27
17	20	17.96
11	19	17.60
4	18	17.42
1	17	17.15

A rise which surpasses 25 pies is dangerous; it may cause a rupture of the dykes or an inundation. From 20 to 23 pies the rises are moderate, and the best years are those when they are between 23 and 25. When the level does not attain 20 pies, certain regions, where the soil is high, cannot be watered. In 1877, when the Nile did not reach 18 pies, a famine ensued throughout the country. The advantage, therefore, of regulating the resources of the river is apparent. In order to profit by the overplus of water at the time of the flood it would be necessary to construct a series of immense reservoirs in the meridional regions of the Valley of the Nile at different levels, capable of storing enormous quantities of water at the time of the flood, to be repaid to the river at low water.

Some years ago M. de la Malte formed a company under the name of "Société d'études du Nil," which appointed M. Jacquet—engineer-in-chief of roads and bridges—to make an especial study of works to be undertaken in Upper Egypt. To this end he explored that part of the country in conjunction with M. de la Malte; and on his return in 1882 published a learned report on the subject.

M. Jacquet proposes to create the first reservoir at Gebel Selseleh. On quitting Assuan in descending the Nile, the river runs for a distance of forty kilos. in a valley closed in on both sides by mountains. The two chains then branch off almost suddenly, leaving the vast plain of Koum Ombas between them, which extends as far as Gebel Selseleh, a distance of thirty kilos. At this point the two chains again run close together, and the Nile traverses a defile of 400 metres in width, forcing its way through the rock as if it had been cut through to give it passage. To the east of this defile there is an opening of 1,800 metres wide in the Arabic chain, which was once evidently the bed of the Nile. At no very distant period the rocks formed a ridge which held back the waters, and thus formed by their deposits the plains of Koum Ombas and Amangar, of heights not now reached by the highest floods. M. Jacquet considers that the plain above the passage of Gebel Selseleh is marvelously situated for the creation of an immense reservoir. It would form a vast circle, shut in on all sides, 30 kilos. long by 50 kilos. broad,—in round numbers, a superficial area of 120,000 hectares. In his rapid survey, M. Jacquet was only able to take certain levels, but he estimated that of the plain as lower than the water mark at Gebel Selseleh, so that as soon as the waters attained 20 metres the whole of the plain would be flooded and every metre raised in this basin of 120,000 hectares would correspond to a store of 1 milliard 200 million cubic metres of water, taking into consideration the capacity of the river's bed as far as the top of the first cataract.

In the first instance, the present bed of the Nile would have to be dammed up in order to raise the level in the reservoir; the old bed situated to the east, as before mentioned, would also have to be barred. It would then be necessary, naturally, to provide a fresh opening for the river; this would be done by opening up two new arms, one serving as a discharge, being 700 metres wide, would be dug to the west of the old bed of the river, while the second, only 300 metres wide, would open into the lower plains and run at the side of the Nile, being, at the same time completely separated from the present bed. Independently of these two branches there would be constructed, firstly, a navigation canal with a series of locks; secondly, an irrigation canal capable of discharging 500 cubic metres per second. Supposing the maximum retention to be 25 metres above the water mark, the lower surface of the waters in the lakes being fixed at 20 metres, seven milliards cubic metres of water could be accumulated, and restored to the Nile during the low-water period.

The first result would be to remove all fear of inundations when the rise of the waters was excessive. As soon as any indication of a flood was perceived, the reservoir could be emptied, and such quantities of the rising water drawn off

as would be necessary to avoid any overflow into Lower Egypt: in fact, the capacity of the reservoir would permit 4,000 cubic metres per second to be drawn off during more than twenty days. On the other hand, when the rise was likely to be insufficient, progressive stores could be made during the ascending period, beginning from the month of July, so as to have the reservoir completely full at the time of the flood. At this point a gradual opening of the reservoir would permit large quantities to be poured into the Nile for a considerable number of days, so as to lessen in a certain measure the evil of an insufficiency. The irrigation canal would besides, according to the project, bring under cultivation a superficial area of 400,000 hectares now lying waste.

The estimated expense for carrying out this project is 100,000,000 francs. Numerous objections have been made to the plan of reservoirs. Losses would occur of the waters of the lake through infiltration and evaporation, it has been stated, and the basin would become choked with slime. These objections have all been satisfactorily disposed of by M. Gallois Bey, to whose report on the question we refer all those who are interested in the matter.

The Government of the Khedive is convinced of the importance of the proposed works, and the Minister of Public Works is concentrating all his efforts toward their accomplishment. There is every hope, then, that the time is not far distant when the country will benefit largely by their realization.—BOGHOS NUBAR, in *The Engineer* (London.)

TENTH ANNUAL REPORT OF THE BOARD OF HEALTH OF THE STATE OF NEW JERSEY.

THE report on vital statistics for the year ending June 30, 1886, which is contained in the tenth annual report of the State Board of Health, does not give death-rates either for the whole State or for parts of it. The birth-rate is stated at 20 per 1,000, which indicates that the returns are very imperfect.

The total number of deaths during the year is given as 22,734, which would seem to indicate a death-rate of a little over 17 per 1,000, which is comparatively low.

The great defect in this part of the report is that there is no study of deaths by localities, to show where there has been improvement or the reverse, or where there are indications of special need for sanitary efforts.

Among the numerous papers and essays appended to the report, one of the most valuable is that by Dr. J. W. Stickler, of Orange, on the diseases of hatters, and it is so because he actually investigated the matter for himself and gives us some definite facts, instead of general advice and quotations.

He found that the most common disease of hatters is catarrhal inflammation of some part of the air-passages, and that consumption is a more frequent cause of death among them than among most other workmen. How much of this is due to true tubercle and how much to dust deposits in the lungs seems to be unknown.

Beyond mere allusions to the fact of its existence, Dr. Stickler seems to have paid no special attention to the mercurial poisoning which is so marked a feature among the diseases of hatters.

The other essays in the book are devoted to popular instruction on various sanitary topics, such as sewerage, water-supply, gas, etc.

The paper on poisoning by new milk, which was published by Dr. Newton in the *Medical News* of September last, is reprinted with some additions. This refers to a number of cases of sickness at Long Branch in which vomiting, diarrhoea, and collapse were produced by the use of milk in which Dr. Newton found the poisonous substance known as tyrotoxin, and which seems to have been developed in the milk in the short space of five hours. Dr. Newton thinks that this was due to the fact that the milk was placed while warm in tight cans and shipped at once for market without having been first cooled. If this were the case it should be easy to prove it, for any milk enclosed while warm in a tight can or bottle should develop the same product. This we doubt strongly. There is reason to believe that some specific micro-organism was concerned in the production of the poisonous substance, and it is to be regretted that cultures were not made and the matter thoroughly worked out.

Taken as a whole the report is an excellent educational document for distribution among the people.

THERE is considerable prospect of the establishment of plumbers' classes in Montreal next autumn in connection with the Government schools.

CARRYING WATER-MAINS ACROSS A RIVER.

At the recent meeting of the Michigan Society of Civil Engineers, Mr. W. R. Coates read a paper describing the method used by him to carry the water-mains for Grand Rapids across the Grand River, which we abstract as follows:

"I first removed," he says, "the old wrought-iron main, and then cleared away the slight accumulation of sand, gravel, and fragmentary rock for a space of about six feet in width on the line the new main was to occupy, and entirely across the river, thus exposing the naked limestone rock. A false work was then constructed directly over the line and entirely across the river. This false work was composed of about seventy trestles placed at intervals of twelve feet, or one trestle to each length of pipe; these trestles were connected together in such manner as to make a good working bridge from which to prosecute the work. The chief purpose of this false work was to serve as a temporary bridge on which to put the line of main together, and from which to lower it to place in the bed of the river; but it also served an excellent purpose as a base from which to conduct the trenching operations. This bridge was eight feet in height, and ordinarily projected from two to four feet above the water, although at times the water was up to the floor-plank.

"The plan adopted for making the trench for the main was, first, to clean off the sand and gravel, as already described, thus exposing the naked rock, then to drill holes at intervals of two feet on the centre line of the proposed trench. These holes were carried to a depth of about thirty inches, and after being completed, were each charged with a ½-pound cartridge of Hercules powder. These charges were prepared in clusters of six, and exploded with electricity, a small dynamo being used for the purpose. Inserted in the upper end was an exploding cap, attached to which were two insulated copper wires, of sufficient length to reach above the water, where they were connected with wires leading to the dynamo. This dynamo was of sufficient power to explode the six charges simultaneously, and could be easily moved from one point to another, as occasion required, and it was not necessary to station it more than fifty feet from the blasts. It was not difficult to so adjust the charges as to secure the desired execution, without disturbing the false work. This very greatly facilitated operations, as without the false work for a working base, a very great amount of time would have been lost in getting to and from the work. The blasts did the best execution when the drill-holes were slightly inclined from the perpendicular. In charging the blasts the cartridges were inserted in the drill-holes and forced to the bottom with a long rod. The overlaying water proved to be sufficient packing to secure the desired execution without sand-tamping, and at the same time leave the false work free from danger from flying rock, as the rock though sufficiently broken up to permit of easy removal, still remained in the trench, from which it was simply raked out upon the sides until after the main was laid, when it was raked back again into the trench and over the pipe, heavy, long-handled hoes being used for this purpose. The trench when finished was in most excellent form to receive the main. From each side of the river toward the centre the bottom of the trench sloped gradually for 300 feet, the entire fall being only one foot, while the middle section of 200 feet was a true level. It is very rarely, indeed, that we can obtain such an even grade entirely across so wide a river.

"After the trench was complete and in readiness, the pipe was put in place upon the false work and joined together preparatory to lowering to place in the bottom of the river. The pipe was of cast iron, in 12-foot lengths, each section weighing 1,500 pounds, and of the pattern known as socket and spigot-joint pipe. The pipe was coated with Dr. Angus Smith's patent varnish, and the joints were made of hemp, gasket, and lead. I gave the joints the greatest depth of lead the socket would permit, in order to secure the highest degree of lateral stiffness. In putting the line together on the false work it was so put together as to conform to the shape of the trench bottom, so that when lowered to place the main would come to a bearing on the trench bottom simultaneously throughout its entire length. When the main was all in place on the false work, and the joints all made, chain-slugs were attached to it at intervals of twenty-four feet, or each alternate section of pipe, and to these chain-slugs were attached screw-rods one and one-quarter inches in diameter and nine feet long. These screw-rods were each provided with a double hook at the lower end, and to these the chain-slugs were attached. The rods, passing up through a heavy, supporting cross-timber, were

held in place by nuts, with lever extensions for turning them. These chains and rods were of proof metal, and capable of carrying sixteen times the load that was placed upon them. I provided this very large safety factor in order to be prepared for every possible contingency. While it was not at all probable, yet it was possible, we might not be able to secure equal duty along the entire line in lowering the main. Of course, if one chain and screw, from any cause, failed to carry its proper load, its neighbor would be overloaded.

"After the slings and screws were all attached, the two shore ends of the main were plugged and braced, and the main filled with water and subjected to a test-pressure of 140 pounds to the square inch. The result of this test was satisfactory to all concerned. After this test the water was drawn from the pipe, as it was deemed best not to carry this extra load in lowering the main to place.

"All was now in readiness for the grand climax of the entire work. In a few short hours we were to know, from actual, practical demonstration, whether our plans were to prove a success; whether our theory and our practice would prove harmonious. The work had been observed with deep interest by the Board of Public Works and by the citizens of Grand Rapids, and very naturally there were many doubts and fears concerning its successful accomplishment.

"The prevalent fear seemed to be that it was impracticable to handle so lengthy and heavy a line of pipe all at once, and that even if this could be done, it would be impossible to resist the force of the current when the line became fully exposed to it. From my own point of view, I had considered all serious obstacles overcome when the rock-trench was completed, and that lowering the pipe to its place in the bottom of the river would be a mere play spell. And so it proved.

"Of course, I had carefully calculated the requirements of the situation, and the means requisite for handling the main, and for resisting the force of the current, and had provided amply for any and all contingencies. And this was not a difficult matter at all; there were no unknown quantities involved; everything could be mathematically demonstrated, almost as easy as two and two make four. If fifty feet of pipe could be handled safely all at once, five miles could be handled just as safely, if everything was proportioned and timed correctly. As to the great bugbear, the current of the river, five minutes' ciphering clearly demonstrated that gravity alone gave an ample factor of safety, the simple weight of our main being such that the current would not affect the line in the slightest degree. These fears and doubts proved quite a disturbing element, however, with many who were very greatly interested in the success of the work, and they were not allayed until the work was fully completed, and they were shown to be entirely groundless.

"Forty men were now stationed along the line of main, one at each screw, and a signal-man with a horn was placed in the centre. At intervals of ten seconds the signal-man gave one blast with his horn, upon which the men at the screws each gave one full turn at the screw-lever at which he was stationed. We first made a few turns to the right until the main was raised sufficiently to permit of the removal of the temporary supports from under the pipe. We then reversed, and turned steadily and uniformly, till the main reached its final resting place in the bed of the river. Two hours and a half only were occupied in accomplishing the task, and our main now rests in its rocky trench at the bottom of the river, with the entire volume of the river quietly flowing over it, instead of, as a few hours before as quietly flowing under it. While the trench in the bottom of the river was in excellent shape, yet I left all the screws attached, and under partial tension, till the trench was partially refilled and the pipe firmly bedded, after which the screws and chains were removed, the refilling of the trench completed, and the false work taken out, and now nothing remained in sight to indicate the scene of our recent busy operations. The main was again tested after it was lowered to place, and found to have sustained no injury in the process of laying. The plan here outlined for crossing rivers with water-mains is superior to any with which I am familiar, and if properly executed will always ensure successful and satisfactory results."

NOTES.

M. CANOVETTI, an Italian engineer, has published a note on the sanitary work done and in progress for the city of Naples, of which the following is an abstract:

The old part of the city is greatly overcrowded by a poor population, and has a high mortality rate. The water-supply was very scanty, but is now abundant, being furnished from a mountain across the valley through an inverted syphon 20,000 metres in length, which now delivers 100,000 cubic metres per day, or about 200 litres for each person. The water is furnished by a private corporation, which charges 25 centimes per cubic metre to householders and furnishes 15,000 cubic metres per day free for municipal purposes. After this water-supply was introduced cholera ceased, although some cases occurred in the suburbs where this supply was not furnished.

A system of intercepting sewers has been decided on to deliver the sewage into the sea at a remote point, and a wide street is to be cut through the darkest and densest part of the city. If all the work which is mentioned by M. Canovetti as being in progress is properly carried out, it will make a great difference in the sanitary condition of the city.

In a paper on Dr. Koch's bacteriological water-test, recently published in the *Lancet*, Professor G. Bischof gives the following as his conclusions:

"(1) The total colonies found by culture in gelatine-peptone do not represent the total actually present in a sample of water, but an indefinite aliquot part thereof. (2) The number of total colonies found does not, within a very wide range, justify the rejection of a sample; no more can a sample be relied on as safe if very few colonies only be indicated. (3) The test, does not, as a rule, allow of distinction between pathogenic and harmless microphytes. (4) Pathogenic microphytes present in a sample of water are apt to escape detection by being crowded out by the organisms ordinarily occurring in water. (5) The relative biological purification indicated by the test in samples of water after filtration through sand is at variance with other well-known facts, and should be accepted with caution."

THE hydrant is the rival of the fire-engine, besides being its assistant. This was clearly recognized in days gone by, and gave rise to some curious scenes. Mr. Edwin Chadwick was informed that when hydrants were first put down at Liverpool, a fire was put out by the hose and jet alone when the appliance was first used; but when the men of the Brigade force arrived on the spot with their engine, they were so enraged with the man who had put out the fire that they attacked and beat him for interfering with what they conceived to be their privilege. Previous to 1862, in one of the sub-districts of London, an officer in charge got the idea that by the insertion of a hose into a plug, or attaching it to a stand-pipe, he could frequently extinguish a fire before the engines reached the spot. The man not only thought it out, but "he did it." Unhappily, in putting out the fire in this fashion, he also extinguished the rewards which the vestries were in the habit of giving to the men whose engine arrived first, second, or third at the scene of the fire. The emoluments for working the engines were also lost. So much obloquy was incurred in consequence, that this man in advance of the age had to abandon the project, both he and the men who acted with him being stigmatized as low fellows—"stand-pipe men."—*Engineering*.

AMONG the regulations recently issued by the Belgian Postal and Telegraphic Administration for the construction of electric-lighting circuits, it is strictly prohibited to make any connections with gas or water pipes. Wherever the lighting conductors cross telegraph or telephone wires, they shall pass underneath the latter at right angles, and at a minimum distance from them of two metres (6½ feet), and, moreover, shall be protected above by a strong wire to prevent contact in case of the breakage of the telephone wires. Electric-light conductors shall not run parallel with telephone or telegraph wires if it can be avoided, but, where necessary, the distance between them shall be at least 12 metres (39.3 feet). The installation must be tested regularly, at least once daily. The contractor shall assume the entire responsibility for all damage or accident arising from his electric-light installations.

THE inhabitants of the Bootle district in the suburbs of Liverpool have lately had an unpleasant, although fortunately harmless, experience in connection with their water-supply. The water, as delivered for several days in succession, was offensive both to sight and smell. It appears that a disused stone quarry in the neighborhood had been loaded up with a material known as "blue billy," which is rich in iron. The pumping-engine being under repair and stationary, the old quarry became flooded, and when started again the water had become impregnated with the material. The water on being analyzed was certified as being quite wholesome, although impure.



THE NAUTICAL ARENA, PARIS.

The following description of this aquatic circus is abstracted from the *Genie Civil and La Nature*:

This institution, inaugurated last year, is intended to furnish an amusement resort in the form of circus in winter and a swimming-bath in summer.

The main hall is a circular one, some 100 feet in diameter, lined with galleries and rows of boxes, elegantly decorated and draped.

In the centre of the hall is a concrete basin some 10 feet deep and 80 feet in diameter, lined with white marble. This basin is supplied with a constant flow of warm water. It has a circular overflow around the sides and also a syphon overflow with automatic air-valve which allows the surface to be kept constantly clear while the water is drawn off from the bottom of the tank. It has a capacity of 42,000 cubic feet and is filled from a well 270 feet deep, furnishing water at 12° Centigrade (54° Fahrenheit). This supply is heated to 23° Centigrade (73° Fahrenheit), by means of the condensed water of the engines in the building. This condensed water is passed through two preliminary tanks so as to draw it off and keep it clear of oil. This hot water flows at the rate of 1,750 cubic feet per hour.

In the middle of this concrete basin is a hydraulic piston supporting a platform 45 feet in diameter. This platform is an open-joint wooden floor, on 20 I-beams radiating from the piston-head and connected by concentric circular beams. On the circumference of the frame-work are guides which slide in grooves in 20 iron columns placed regularly all around the outside. There are also 5 columns around the piston 5 feet out from it, which are held to the frame by their heads and slide in cylinders sunk in the masonry foundation to the ram. When the ram is run out to its full height the whole platform is made to revolve by means of hand gears sufficiently to bring the guides out of the grooves of the columns and bring them over brackets on which they are lowered slightly and thus steady the whole system. By the same motion the five centre posts are drawn from their casings and brought to bear on foundation blocks. In this position the whole frame-work is perfectly steady and can stand the equestrian evolutions upon it without any appreciable vibration.

This whole movable frame-work weighs about 30 tons, and the raising is done by means of 4 pumps absorbing about 5 horse-power. Each operation of raising takes 80 gallons of water at from 25 to 35 atmospheres of pressure. It takes 5 to 6 minutes to raise it and from 1 to 2 to lower it.

In summer the platform is lowered to a depth of about 3½ feet and supported on brackets which revolve on the 20 columns. This forms a shallow bath for children and those who cannot swim. It is connected to the bank of basin by means of an iron bridge. The outer basin forms a swimming bath 19 feet wide all around the outside of the other and some 10 feet deep.

In winter this annular bath is covered by iron girders forming tiers of seats reaching up from the centre ring to the second floor which is arranged with boxes and a circular passage outside. The inner platform is covered with a mat of cocoa-fibre all in one piece, which weighs some 2 tons, on which the horses perform as on the ordinary tan, with the advantage that it gives no dust. When they get to the nautical performances the mat is rolled up and drawn off on special trucks, then the platform is gradually lowered into the water.

In summer the boxes on second floor are transformed, the sides being swung around to form dressing-rooms against the wall with a passage in front. Similar rooms are extemporized on first floor; there are 60 on each floor.

The question of heating the hall was quite important so as to prevent all condensation of moisture from this large body of water, on the walls, etc. The hall has a capacity of 530,000 cubic feet.

By means of a fan-blower seven feet in diameter, air is taken above the roof and carried through three hot-air furnaces before being delivered into the hall under the second floor seats at 104° Fahrenheit. The outlet is in a

cupola over the hall. The temperature of the hall is thus maintained at from 64° to 70°. In winter 1,412,000 cubic feet of air is blown in per hour; in summer 2,118,000. This increased amount was found necessary on account of the larger surface of water uncovered when the seats are removed.

Around the main hall are rooms for hydropathy, hot-air baths and vapor baths, besides small bathing-rooms for washing before going to the swimming-bath.

The ell of building contains stabling for 20 horses and paraphernalia, which is changed into a gymnasium in summer. On the upper floors are a gymnasium, fencing-room, smoking and reading rooms, and café.

The main entrance has a fine vestibule and elaborate stairway, built by Charles Garnier, architect of the Opera House; the building having previously been used for a panorama of the Battle of Reischhoffen.

The whole is lighted by electricity.

In the large hall, eight Soleil lamps with opal globes and a star formed with ten Jablochhoff horizontal candles; and a garland of 400 Edison lights in the front of balcony. There are 60 incandescent lights in the corridor.

At entrance four Street & Maquaire arc lights.

In café four Soleil lamps.

In all 1,200 incandescent lights of half ampere, placed on three circuits to prevent all danger of total darkness in case of accident. For instance, in the boxes there are 5 lights, 2 on 25 horse-power Edison dynamo, 1 on battery of 60 accumulators and the other 2 on 25 horse-power Edison dynamo. The accumulators are being charged during the day time.

The Jablochhoff lights are connected to two alternative Maquaire machines excited by two small dynamos.

The power is taken from two 60-horse-power engines on one fly-wheel and from one 30-horse-power engine, all of the Corliss type, built by Lecouteux & Garnier. The boilers of Collet type are arranged for fine fuel.

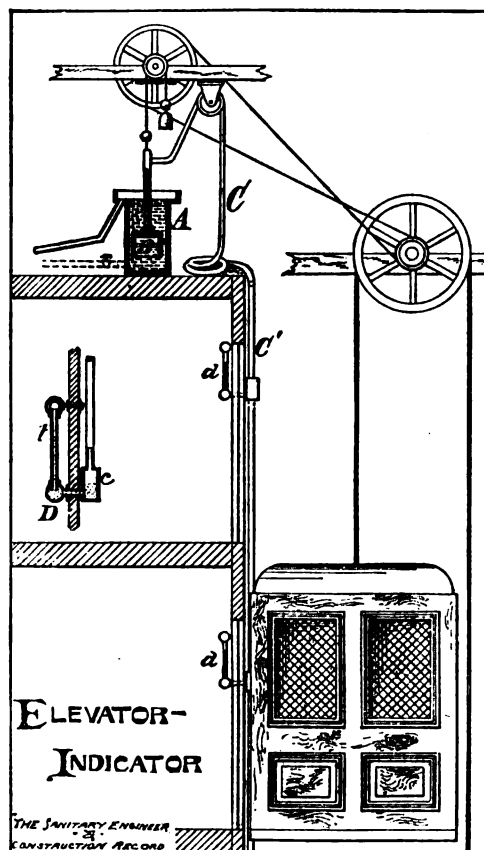
Architects Gridaine & Sauffroy; frescoes, by Delaunay; engineering, Jules Solignac; hydraulic work, Edoux.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

ELEVATOR-CAR INDICATOR.

The accompanying drawing illustrates a novel elevator-car indicator, recently patented by Q. N. Evans, of No. 12



Cortlandt Street, New York, and in use in the new Cotton Exchange Building and in the Astor Building in Wall Street, the object of which is to show the position or floor at which the car of an elevator may be to persons on any of the other floors of a building and indicate the direction of its movement.

The apparatus consists of a water-tank A, diving-bell B, flexible tube C, and permanent iron pipe C', the latter connecting with the indicators d d', shown in enlarged section at D.

The indicators consist of a glass tube (t) similar to a water-gauge glass, and a cup (c) or small reservoir of colored water.

The principle taken advantage of is the compression of air by the diving-bell as it is submerged in the water; the compressed air acting through the hose and tube C on the surface of the water in the little reservoirs c c forces it upward in the tubes t t, which latter are marked to correspond with the level of the floors.

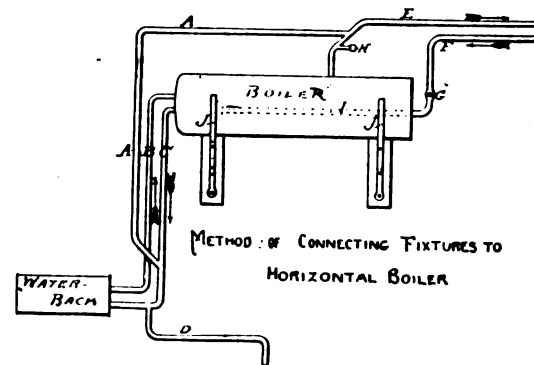
It may appear to a close observer that the expansion of the air by heat or loss by leakage would disarrange the whole adjustment, but this is provided for by the diving-bell being just drawn out of the water every time the car reaches the top of the house, allowing the atmosphere to equalize itself each trip of the car. Motion is given to the diving-bell by the differential pulleys and belt, as shown, and here again self-adjustment comes into play each trip. Stop-balls on the balance-chain from the head of the diving-bell are made to strike stops as shown, so that should there be slip or lost motion, a ball will strike either on the up or down position, causing a slip of the chain over the pulley at the head of the diving-bell.

An overflow-pipe is provided to the tank A, and a slight drip of water from a small pipe continually falls into the tank to make up for loss by evaporation. The water in the glass tubes is colored red to contrast with the glass itself, that it may attract the attention of the unobservant.

METHOD OF CONNECTING FIXTURES TO HORIZONTAL BOILERS.

ASBURY PARK, N. J., May 31, 1887.

SIR: I was helping a plumber fit up a house at Lakewood, N. J., and they wished to get the boiler out of the way on account of small kitchen. It is a 40-gallon vertical boiler set up in a horizontal position. Will you kindly illustrate it in your next issue for comment, to see if I can obtain a better way for doing same? The boiler is always hot at the top as well as at bottom, and the pipes are so hot between water-back and boiler that you cannot put your hands on them. Hoping this will meet with your approval, I remain, yours respectfully, HELPER.



- A. Circulation.
- B. To boiler from water-back.
- C. To water-back from boiler.
- D. The sediment.
- E. Hot water to fixtures.
- F. Cold water to boiler.
- G. Check-valve.
- H. Vacuum-valve.
- I. Tube for cold water.
- J. Brackets that support boiler.

[We are always willing to give space to our young readers who want a criticism of their work when they make us a good sketch. We have no fault to find with the arrangement shown, as it will undoubtedly circulate well unless the pipes are obstructed. There are other ways of doing it, and as it may be only a difference of opinion as to whether they are better or not, we refrain from reproducing any of them, but if some more of the helpers will send us their method of doing it we will publish it.]

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

CONTRACTING ENGINEERING AND PLANT. KEYSTONE BRIDGE COMPANY, } PITTSBURG, June 11, 1887. }

SIR: I note in your issues of April 30 and May 7 in the discussion of our traveler on the elevated work for the Suburban Rapid Transit Co. that I have been accredited with designing same. If credit belongs to any one in this matter it is to our Superintendent of Erection, Mr. George Buchan, now in charge of the erection of the Missouri River Bridge at Kansas City. In discussing the erection of this work some time last fall I suggested the idea of the overhead traveler with long swinging arms, and he worked out the details. The idea even was not original with me, as I saw the same principle applied by Mr. Lassig, of Chicago, in St. Paul, early in the year 1884. Yours very respectfully,
A. F. BROWN, General Manager.

MACHINE FOR TESTING STRENGTH OF BUILDING MATERIALS.

OFFICE OF BOARD OF EDUCATION, }
MINNEAPOLIS, MINN., June 7, 1887. }

SIR: Mr. Gates A. Johnson, of St. Paul, Minn., can find a first-rate testing-machine for all kinds of building materials in the State College of Mechanic Arts in this city. Professor William A. Pike conducted a series of experiments for me while I had charge of the department of building inspection, which were satisfactory in every respect. The college is probably the best equipped of any in the State for this work, and Professor Pike has been willing to make tests of materials when the purpose was to benefit the public in general. Sincerely yours,

WALTER S. PARDEE,
Supervising Architect Board of Education.

HOW TO MAKE CELLARS DRY.

NEW YORK, June 10, 1887.

SIR: Will you kindly inform me through your paper what I must do to make my cellar dry.
The floor is concreted, and there are windows back and front, but it is damp, and everything gets moldy in it.
Yours,
"MORRISANIA."

[It is not generally understood that all mixtures of cement or lime with sand, etc.—in other words, all mortars—are more or less porous, and that they will all absorb moisture.

This being true, if a hole be made in the ground and walled up, and the bottom concreted ever so well, it is only necessary for water to stand against the exterior for some of it to be absorbed. In time the concrete and the stone or brick may become saturated, or nearly so, and evaporation will take place at the interior, tending to cause dampness.

For this reason it is always well, where practicable, to have tile drains around a house at a depth at least as low as the bottom of the foundation (of course with a suitable outfall) so as to promptly remove the soil-water. If this be done the walls and bottom will never become saturated with wet, and the cellar will be dry.

A second remedy is to coat the bottom and sides with a layer of damp-proof material. The rock asphalts are best. The natural bitumens and the coal-tars also serve a good purpose. This must be done by persons familiar with the work.

In building a new house a damp-proof course in the walls near the bottom and bitumen, etc., outside and in the bottom are used.]

ERRATA.

IN our reply to "Earlham," page 15, issue of June 4, the last line of the second column should begin to read "inlets to each room," etc., instead of "inlets to six rooms."

OUR attention has been called to the fact that the fulcrum of the automatic damper-regulator shown on page 689 of our issue of May 28, Vol. 15, is on the wrong side of the power or centre post of the bowl, when the apparatus is used to govern a draught-door.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
June 11.....	27.84	20.99	22.14	30.72	28.68	24.63	32.81

E. G. LOVE, Ph.D., *Gas Examiner.*

EXPERIMENTS have been successfully conducted for a week past on the lighting of the Hoosac Tunnel by the Westinghouse system of electric-lighting. The work is done by the Westinghouse Electric-Light Company of Pittsburg.

THE Boston Electric Club was partly organized on June 12. The following committee was appointed to consider and report a complete plan of organization at a meeting to be held on Tuesday, June 21, at the offices of *Modern Light and Heat*: Frank Ridlon, of the Brush-Swan Electric-Light Company; W. B. Hosmer, of the Thomson-Houston Electric Company; A. H. Chapman, of the New England Telephone Company; H. H. Eustis, of the Eastern Electric Cable Company; B. S. Flanders, of the city Fire Alarm Department; R. F. Ross, of *Modern Light and Heat*; W. I. Barker, of the *Electrical World*, and F. Gilley, of the *Electrical Review*.

BOSTON SOCIETY OF CIVIL ENGINEERS.

A REGULAR meeting of the Boston Society of Civil Engineers was held Wednesday, June 15, thirty-one members and three visitors present.

Messrs. Nelson Spofford and George N. Barrus were elected members and two names proposed for membership.

Announcement was made of the death of George A. Parker, an honorary member, and a committee appointed to prepare a memoir.

Mr. Edward S. Philbrick read a paper on "The Land Slide on the Boston and Maine Railroad, at Dover, N. H., May, 1884."

It was voted to omit the July and August meetings.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING was held Wednesday evening, June 15, President W. E. Worthen in the chair, and John Bogart, Secretary.

The subject presented, "Construction of the Panama Canal," was given in a very entertaining manner by M. T. Bowlonge, a French engineer, who has been in charge of a portion of this work.

He stated that the profile prepared for the work indicated only the greatest depressions and elevations of the surface. Of the total estimated quantity, 140,000,000 cubic metres only 30,000,000 cubic metres has been removed, or one-fifth. There are areas of marshland on both eastern and western slopes that have never been surveyed; the construction of these areas to be done after the more elevated portions are completed, postponed on account of their fever-producing quality. These marshes are filled with timber, and covered to a depth of two feet with water during the dry season.

The large dredge in use there removes the material by scooping it out in front of the dredge. The highest elevation a lock can be built and obtain a necessary supply of water would be 11.8 metres above tide. He confirms the reported sliding of slopes on a portion of the line. Description of climate was severe for the Isthmus, as he stated it to be dry for three months and raining day and night for the remaining nine. It is extremely difficult to obtain laborers on account of the climate. Negroes from Africa cannot be obtained without force, and it required three months in one instance to obtain 171 negroes, but they proved to be strong.

The death-rate among the whites has been eighty per cent. Out of seventy-two foreigners holding positions as agents, clerks, and draughtsmen, only eleven are now on the work, 45 per cent. have died, and the remainder have returned home. The work can be continued only four months longer with the funds now on hand. At one point the surveyed lines do not connect, but lap each other, and it will require a new survey if work is continued to completion.

The committee having charge of the arrangements for the convention, Messrs. W. G. Hamilton, Stephenson Towle, and John Bogart, will visit Hotel Kaaterskill on Thursday, the 16th, to make final arrangements for the comfort of the members and guests.

PERSONAL.

MR. HENRY W. ROGERS, President of the New England Water-Works Association, has become General Superintendent of the works and undertakings of the Gardiner Water Company, of Maine.

BREVET MAJOR-GENERAL JOHN G. PARKE has been appointed Superintendent of the United States Military Academy at West Point, N. Y.

ARCHITECTURAL COMPETITIONS:

PLANS FOR STATUES.—The Trustees of the James Lick Trust, of San Francisco, Cal., invite designs on paper for the construction of the groups of historical statues to be erected in the space set apart in front of the City Hall of San Francisco, Cal., and in accordance with Thirteenth Trust in James Lick's Deed of Trust.

All the plans to be submitted shall be made on a scale of not less than three-fourths of an inch, and not more than one inch to a foot, and from the various designs which may be submitted, three will be selected by the trustees for consideration and further modification to be made, if found desirable. The artists submitting these three designs selected will be invited to submit models and full details for competition. The artist whose plans and models are finally selected from these three will be entitled to enter into a contract, containing proper covenants and agreements, for the construction of the work, with said trustees, and the remaining two, whose designs are not accepted, will receive five hundred dollars (\$500) each. Prominence to be given to bronze in composition of statues, as required by the terms of the Thirteenth Trust. Preference, so far as practicable, to be given to materials obtained in California. Sketches to be all submitted on or before the 15th day of September, 1887.

The expenses of advertising and other incidental expenses, and the sum of \$1,000 for the purpose above mentioned, will be reserved from the sum of \$100,000 for the statues.

The trustees reserve the right to reject any or all sketches and designs submitted.

For further information address H. E. Mathews, Secretary, San Francisco, Cal.

NEW YORK CITY.—The Grant Monument Association calls for designs for the Grant Memorial in Riverside Park. Designs should be sent to 146 Broadway before November.

TRADE CATALOGUES.

THE Holly Manufacturing Co., of Lockport, N. Y., have sent us their new 1887 catalogue describing the gas-kilns, hydrants, and valves manufactured by them.

THE Messrs. John Wiley & Sons, 15 Astor Place, New York, have sent us their new circular catalogue entitled "Practical Works and Text-Books on Civil, Mechanical, Mining, and Marine Engineering, etc., containing full titles, descriptions, and press notices, selected from the latest catalogue of our publications." Copies will be sent free on application.

PUBLICATIONS RECEIVED.

REPORTS FROM THE CONSULS OF THE UNITED STATES. No. 76, April, 1887. Washington: Government Printing Office. 1887. Also Reports from Consuls, Nos. 77 and 78. Washington: Government Printing Office. 1887.

ANNUAL REPORT of the Chief Engineer Board of Public Affairs, Cincinnati, O., for the year ending December 31, 1886. H. J. Stanley, Chief Engineer.

SIXTH ANNUAL REPORT of the Board of Water Commissioners of the city of Amsterdam, N. Y. A. H. De Graff, Superintendent.

ANNUAL REPORT of the Board of Public Works of the city of St. Paul, for the year 1886. L. W. Rundlett, City Engineer.

ANNUAL REPORT of the Board of Health of the city of Toledo, O., for the year 1886. C. L. Van Peet, M. D., Health Officer.

MISCELLANEOUS.

LITTLE ROCK, ARK.—The Little Rock Electric-Light Company will erect a new building for their plant.

DECATUR, ALA.—The Decatur Wire-Fence Machine Company, capital stock \$25,000, has been organized.

BESSEMER, ALA.—The Bessemer Brick Company has been incorporated, capital \$50,000, for the manufacture of brick, tile, etc.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 61-62-63-64.

WATER, SEWERAGE, ETC.

SYRACUSE, N. Y.—The surveys are nearly finished for the reservoir of the Syracuse Water Company at Osceola in Lewis County.

SALT LAKE CITY.—Note the movement now going on to raise funds for an extension of water-mains in this city.

NEW YORK CITY.—The Hydraulic Reclamation Company has been incorporated. Capital stock, \$100,000. John B. Bolles and others are incorporators.

MONTROSE, PA.—Address A. Lathrop, Chairman of the Building Committee, about water-works which it is proposed to establish here.

WATER COMPANIES.—The Council Grove Water Company, of New York City, has been incorporated; capital stock, \$100,000; George B. Inman, and others, incorporators. The Worcester Water Company, Worcester, N. Y., has been incorporated; capital stock, \$35,000; H. H. Smith, and others, incorporators.

ALBANY, N. Y.—The latest proposition about a water-supply comes from Andrews & Co., who offer to furnish 10,000,000 gallons daily from wells sunk in the Van Rensselaer Flats at \$237,500 per year. If this plan is accepted, the water will be first conveyed in a 42-inch iron main to the Blecker Reservoir. Further, dams will be built on Patroon Creek, above the contamination in "Sand Creek," and a reservoir, with a capacity of 15,000,000 gallons, will be built near the Tivoli Lake. A \$20,000 filter plant will also be constructed. The total cost is estimated at \$1,000,000.

PHILADELPHIA, PA.—To meet current demands for extension of the water-service, the Water Bureau needs much new iron pipe.

GLOVERSVILLE, N. Y.—\$20,000 will be expended in constructing sewers. The Village Trustees have the matter in charge.

WELLSVILLE, O.—This town will have sewerage as soon as possible.

MUSKEGON, MICH.—The citizens have started a movement for sewerage. Address the Mayor.

ANDOVER, MASS., has a bill in progress in the State Legislature giving the town authority to obtain a water-supply.

SACCARAPPA, ME.—The town meeting of June 8 indefinitely postponed action on the proposition of the Portland Water Company to furnish water at \$2,500 per annum.

TOLEDO, O.—Mr. S. P. Axtell appeared before the Water-Works Board recently and put in a proposition for a plant to furnish 5,000,000 gallons of pure water filtered by the Hyatt system every 24 hours for less than \$100,000.

NORWALK, CONN., will have a system of sewers. Work will be begun immediately.

CHATTANOOGA, TENN.—We stated in our issue of May 21 that a filtering plant was to be put in here. The contract for the plant has since been let to National Water-Purifying Company, 145 Broadway, New York.

CITY OF MEXICO.—We recently noted that the Bucyrus Construction Company, of Bucyrus, O., has been awarded the contract for draining the Valley of Mexico. The contract is for \$4,000,000, on the understanding that the work shall be successfully carried out. Daniel P. Ellis, W. H. Harris, and others of Cleveland, are the company.

BOSTON Board of Aldermen are considering the appropriation of \$30,000 for sewage-pumping engines at the Dorchester Bay tunnel.

ALBANY, GEO., will have water-works; also a street-railroad.

WARSAW, ILL.—The Business Men's Association should be addressed in regard to obtaining water from a well system.

BOWIE, TEX., is taking steps to secure an artesian well.

GREENVILLE, MICH., is taking steps to obtain a water-supply.

MILWAUKEE.—Bonds will be issued as follows: Intercepting-sewer bonds, \$60,000; water-works bonds, \$500,000.

PORTLAND, ME.—The City Council, June 6, accepted the new contract with the Portland Water Company, by which the company agrees to construct as soon as practicable a reservoir on Munjoy Hill, at the same elevation as that on Bramhall, with not less than 15,000,000 gallons capacity, to be completed on or by January 1, 1889.

ALLEGHENY, PA., has a committee of the City Council inquiring about a better water-supply. Address Councilman Seaman.

STEELTON, PA., will have water-works. President Wood is chairman of the committee of inquiry.

GERMANTOWN, PA., needs additional water-mains.

SALT LAKE CITY, UTAH, is discussing the obtaining of a better water-supply for drinking and household purposes.

NASHVILLE, TENN.—The enlarging of the water-works is going on under the direction of City Engineer Jewitt. There will be a filtering plant, pumping-engines capable of furnishing 4,000,000 gallons daily, and a reservoir. The contractor is Mr. Holmes.

GLOVERSVILLE, N. Y.—A special election will be held to vote on raising \$5,000 for sewers.

NEW BRUNSWICK, N. J.—A movement is well under way to convert Lyle's Brook into a covered sewer. Address Professor Austin Scott in regard to the matter.

ATHENS, FLA.—Steps are being taken to obtain water-works.

WATER-COMPANY.—Chartered is the Artesian Water-Company, of Memphis, Tenn.

WATER-METERS.—See our "Proposal" columns for proposals for water-meters needed by the Spring Valley Water Company, of San Francisco, Cal.

DENTON, TEX., will have two new artesian wells.

JOLIET, ILL.—The city is seeking to buy the works now controlled by New York parties.

PITTSFIELD, MASS.—A bill is before the State Legislature providing for better sewerage in this place.

GREAT BARRINGTON, MASS., Water Company will increase its stock by \$50,000.

SANTA FE, N. M., is projecting an important work in the way of water-supply. It is proposed to build storage-reservoirs in the foothills and bring the water by ditches to the city for irrigation and power.

BURLINGTON, VT.—The water-main will be extended 300 feet into the lake. A fire-proof fuel shed will also be built. For both \$9,000 has been appropriated.

WATER COMPANIES.—The Beaver Dam Water-Works Company, Beaver Dam, Wis., has been incorporated. E. G. Ferris, and others are incorporators.

The Panama Water-Supply and Improvement Company, New York, N. Y., has been incorporated. Conrad N. Jordan, and others are incorporators.

RALEIGH, N. C.—J. C. Brewster has the contract for building a system of sewerage in this city. He will want vitrified-pipe.

WALLA WALLA, WASH. T., needs an engineer to design a water-works. Address W. H. Reed.

KALKASKA, MICH., is agitating the obtaining of a water-supply.

MECHANICSVILLE, IOWA.—Address George W. Fall, or Dr. N. S. Hubbell, about obtaining a water-supply here from artesian wells. A report upon the subject will soon be made.

ATHENS, GEO.—The question of water-works is being considered.

GRIFFIN, GEO.—A proposition has been made to build water and gas works. For further information address the Mayor.

SANFORD, FLA.—The Sanford Water Company has awarded the contract for a reservoir to Louis McLain. They will erect a new pump.

ATHENS, GEO.—The question of a sewerage system is being agitated.

RIVERHEAD, L. I.—The subject of obtaining a water-supply is being agitated.

DENVER, COL.—The Cortez Water Company has been incorporated; Franklin M. Lawrence and Seth L. Larrabee, incorporators.

MONTCLAIR, N. J.—The Township Committee has closed a contract with Mr. E. B. Bartlett for a supply of water for ten years. The source will be wells sunk in the northern part of the township.

BOWIE, TEX.—The City Council will issue \$4,000 in bonds to drill an artesian well and build water-works.

WATER-WORKS.—Works are projected in the following towns: Bartlett, Iowa; Nickerson, Kan.; Sycamore, Ill.; Kinsley, Kan.; Columbus, Wis.; Manitou, Col.; Scotland, Dak.; Walnut, Iowa; Wakefield, Neb.; Halstead, Kan.

INCORPORATED is the Great Falls, Mont., Water-Power and Town Site Company; will build works. Louis G. Phelps, V. Wilson, and C. A. Broadwater are incorporators.

WALLA WALLA, WASH. T.—There is a project on foot to obtain water-supply by conducting the water from a creek about a mile above the village, carrying the iron pipes along the side of the cañon in which the creek flows, to a reservoir to be constructed on a hill top, then distribute the water through the village.

BURNET, TEX.—It is reported that A. R. Johnson contemplates building water-works.

MANCHESTER, TENN.—The question of water-works is being agitated.

MORGAN, TEX.—The Morgan Works and Ice Company has been organized, capital, \$5,000, to establish water-works and ice factory.

GAS, STEAM, BUILDINGS, ETC.

INCORPORATED in Ohio is the Winget Oil and Gas Company of Wapakonnet, capital \$5,000.

ROCKLAND AND NORTH ABINGTON, MASS., has appointed a joint committee to investigate systems of street-lighting. The committee recommends the Patton naphtha gas. The cost of introducing it will be about \$20,000, of which \$15,000 has already been raised.

ATHOL, MASS.—The House of Representatives has passed a bill allowing Athol to be lighted with water-gas.

COMPANIES.—The Electric Service Company of Buffalo filed a certificate of incorporation June 6. The capital stock is \$40,000.

The certificate of the increase of the Buffalo Gas-Light Company's capital stock from \$500,000 to \$1,000,000 was filed June 6. The number of shares now out is 20,000.

WESTFIELD, N. J., is investigating systems of electric street-lighting. Address Mayor Miller.

SCHENECTADY, N. Y.—The Edison Electric-Light Company will remove its works from Harrison, N. J., to this city, where works will be built.

NEW BRIGHTON, STATEN ISLAND.—The Electric-Light and Power Company is incorporated; capital, \$10,000. A. K. Gregory, Philip S. Swain, Robert Maitland, all of Brooklyn, are incorporators.

GREENVILLE, N. J.—The Taxpayers' Association will soon hold a meeting to provide means for obtaining gas, also for sewers.

CUMMINSVILLE, O.—The North Side Natural-Gas and Oil Company has sunk a gas-well here, and will lay mains.

CLEVELAND, O.—The Board of Industry is now developing plans for sinking gas-wells, improving the dockage, dredging the river, and building a belt line of railroad along the water front.

CAMDEN, N. J.—The Lighting Committee, of Camden City Council has awarded contracts to the Camden Gas-Light Company and the Wheeler Reflecting Light Company (Limited), of Philadelphia. The former bid was \$25 per annum per lamp, and the latter kerosene oil at \$20. The Camden Electric-Light Company bid \$146 per lamp per annum. Contracts for lamp-posts were awarded to Morris, Tasker & Co. (Limited), for \$7.25 per post, and for street lanterns, to J. Hall Rohman at \$2.70 each.

STILLWATER, MINN.—Bids for lighting the streets were lately received as follows: The local gas company, 200 lamps of 16 candle-power, \$3,200; the Incandescent Company, 200 lamps of 25 candle-power each, per year, \$5,000, and the Stillwater Arc-Light Company, 40 lights of 2,000 each, equaling 80,000 candle-power, \$125 a lamp per year.

BIRMINGHAM, ALA.—The Walker County Coal-Oil Company has been organized; capital stock \$50,000.

GAS CONSOLIDATION.—The Bay State Gas Company, a New York corporation, is trying to arrange a consolidation of all the Boston gas companies under its control. The company will build a plant, acting through the Beacon Construction Company. Elisha S. Converse, Asa P. Potter, and Henry D. Hyde are the advisory committee.

SOUTHBRIDGE, MASS., Electric-Light Company is incorporated, with H. C. Wells, C. A. Dresser, A. Hall, and others, directors.

ALBANY, N. Y., Common Council has voted franchises to the Edison Electric-Light Company and the Municipal Gas Company permitting them to furnish electric-lights for streets. The company are required to furnish 16-power incandescent lamps.

INDIANAPOLIS, IND.—Several propositions are before the city, looking to the erection of a natural-gas plant, and furnishing of the gas for fuel. One of them is presented by the Standard Oil Company.

DENVER, COL., is taking steps to secure natural-gas. An experimental well has been sunk with success; \$25,000 will be raised for the work. Address J. Bristin Walker, of the Chamber of Commerce.

NEW YORK CITY.—The Citizens' Freeman Electric-Light Company has applied to the Board of Aldermen for permission to erect poles and string wires throughout the city, and offers to furnish to the city as compensation for the franchise, all the 2,000 candle-power street-lights it wants at 20 cents a night of ten and a half hours, one free light for every fifty lights furnished to private consumers, and to pay one cent per linear foot of streets occupied.

STILLWATER, MINN.—The Stillwater Electric-Light Company was organized June 10; President, R. F. Hersey; Secretary, R. H. Bronson.

AUSTIN, TEX.—The following charters have been granted: the Edison Light and Power Company, of Fort Worth; capital, \$50,000; incorporators, Sam Hunter, J. W. Schuber, J. G. Watkins, T. T. Cornise, and Max Elser. The Denison Natural-Gas, Coal and Mining Company; capital, \$60,000; incorporators, J. E. Streeper, T. B. Hanna, W. A. Tibbs, A. R. Collins, J. R. Carr, E. T. Hathaway, and George Brown.

PARKERSBURG, W. Va.—The city has granted exclusive privilege to the Natural-Gas Company to use the streets for gas-mains for ten years, natural-gas to be furnished for heating purposes only. The company is composed of Senator Camden, George W. Thompson, C. H. Sattuck, Henry C. Jackson, J. N. Camden, Jr., and others.

BOSTON.—The American Conduit Company will lay electric conduits here.

WARSAW, ILL.—The Warsaw Electric Light Company will light the streets. It is expected the work will be finished by July 1.

NEW YORK CITY.—Franchises for the supplying of electric lights for lighting have been given to the American, the Waterhouse, the Bell, the North New York, the Harlem, the Mount Morris, and the Mutual Union Electric Light Companies.

MOBILE, ALA.—The Progress Electric Light Company has signed the contract for lighting the streets.

GAS COMPANIES.—Incorporated are the Jerseyville, Ill., Electric Light and Power Company; capital stock \$29,000; incorporators: John G. Schwarz, Wallace Leigh, Walter E. Carlin. Also the Stillwater Natural Gas and Coal Company, of Dayton, O.; stock \$5,000.

RAILROADS, BRIDGES, CANALS.

KNOXVILLE, TENN.—A charter was filed June 9 incorporating the Atlanta, Knoxville and North-western Railroad Company. The charter members are Alexander A. Arthur, M. L. Ross, and W. R. Tuttle, of Knoxville; George B. Eager and R. M. Pulsifer, of Boston, and James V. Jackson, of Augusta, Geo. They will build a road from Atlanta to Knoxville, and from Knoxville to a point at or near Cumberland Gap, where a connection will be made with the extension of the Louisville and Nashville and Norfolk and Western Railroads. Grading will be begun within a few weeks.

DEADWOOD, DAK.—The town is taking steps to have the Elkhorn Valley Railroad extended to Deadwood. Address D. A. McPherson.

SIoux CITY, IOWA.—The Sioux City Bridge Company will begin work on the railroad bridge here at once. Marvin Hughitt, of the Chicago and Northwestern Railroad, is president.

BROOKLYN.—Commissioner Conner has determined to spend \$215,000 in paving some of the streets of the Twenty-sixth Ward.

COSHOCOTON, O.—The Coshocton and Southern Railroad proposes to build a road, and is now making surveys. J. C. Pomerene, of Coshocton, is a director.

NEW YORK CITY.—The Dock Department will widen West Street to 250 feet, rebuild Piers 35 and 36 and the line of bulkhead.

RAPID CITY, DAK.—The narrow-gauge railroad will be built by E. B. Chapman, of Omaha. It will be about thirty miles long. Murray Bros., who have the contract to grade thirty miles of the Fremont, Elkhorn and Missouri Valley roadbed west of here, have arrived from Oakdale, Neb., and will begin work at once.

SANDY HILL, N. J.—The Board of Trustees advertise for granite blocks and crushed stone for street work.

CHILLICOTHE, MO.—Bridge Commissioner J. G. Powell has reported to the County Court recommending the construction of his iron bridge, one over Grand River and one over Shoal Creek, at a total net cost of \$9,015.

DUBUQUE, IOWA.—President Touzalin, of the C. B. & N. R. R., will let a contract in a few days for a railroad bridge over the Mississippi.

RAILROAD.—Incorporated is the Minnesota and South-western Railroad Company to construct a line from Northern Pacific Junction south-east to the boundary of Minnesota and Wisconsin. James M. Paine, Edgar M. Wilson, Horace P. Breed, Frank W. Booth, and others, are directors.

LITTLE ROCK, ARK.—Articles of association have been filed with the Secretary of State by the Hope and Shreveport (La.) Railway Company. The capital stock is \$500,000. The directors are J. T. West, W. Y. Foster, S. W. Bundrige, C. T. Short, Patrick Donnelly, R. M. Thompson, and Edward Alexander. The road will pass through the Counties of Hempstead and Lafayette, a distance of fifty miles. The principal offices will be located in Hope.

MILWAUKEE.—The Milwaukee City Railway Company will extend its tracks into Bay View (17th Ward), as follows: On Reed Street, Maple, Clinton, Becher, Robinson Avenue, Lincoln Avenue, Howell Avenue, Potter Avenue, Clement Avenue, Superior and Estes Streets.

ELIZABETH, N. J.—Henry H. Isham, of New York, and Adjustment Commissioner Frederick L. Heidritter, of Elizabeth, will build a street railroad.

LITTLE ROCK.—R. F. Wilson, Street Contractor, has closed a contract with Weigel & O'Keefe to furnish Fourche Mountain granite for street paving.

RAILROAD.—The Stateville and Western Railroad of Texas is extending to Taylorsville, Tex.

RAILROAD.—The Winnipeg and Hudson Bay Railroad asks the Provincial Legislature for authority to raise \$10,000,000, for extending the railroad.

RAILROAD.—The Columbus, Lima, and Western Railroad is being extended in the city limits.

STRATFORD, CONN.—The N. Y., N. H. & H. R. R. is surveying the depot grounds, with a view to improvements.

SPRINGFIELD.—Surveys are in progress for the Springfield, Shellyville, and Mount Carmel railroad.

KNOXVILLE, TENN.—The Marietta and North Georgia Railroad Company will build an iron bridge to cost about \$100,000.

CLEBURNE, TEX.—The contract to extend the Gulf, Colorado, and Santa Fe Railroad has been awarded to Ricker, Las and Company, of Galveston.

CORSICANA, TEX.—Messrs. Roche and Tierney have been awarded the contract to extend the St. Louis, Arkansas and Texas Railroad, from Corsicana to Hillsboro.

DALLAS, TEX.—The Missouri Valley Iron Bridge Company have been awarded the contract to build an iron bridge across Trinity River.

CHAUTAUQUA LAKE, N. Y.—Mr. Elnathan Sweet, State Engineer, is considering the dredging of the outlet of this lake. A bill is before Governor Hill appropriating \$30,000 to the work.

NEW YORK CITY.—The Board of Health will cause the Mott Haven Canal to be dredged out.

BIDS OPENED.

KEARNEY, N. J.—The contracts for constructing the new Soldiers' Home buildings in Kearney have been awarded to E. B. Vliet and Dey & Goble. E. B. Vliet will do the carpenter-work for \$71,000. Dey & Goble will do the mason-work. The contracts have been accepted and the necessary bonds have been given. Work will be commenced at once, and will have to be completed in six months.

MONTREAL, CAN.—Bids for supplying chainstone crossings, flaggings, etc., and also for sewer construction have been received by the Road Committee, as below. The contracts were awarded as follows: A. Desmerault, straight stone curbing, 53c. per foot; curved stone curbing, 60c. per foot D. Lawrence, sidewalk flags, 4x2 feet, at \$2.20; 6x3 feet, \$2.85; crossing flags, 20 inch wide, 50c.; 24 inch wide, 55c. The contract for hauling and laying the various kinds of stone was awarded to Mr. John Parker, at prices ranging from 13c. to 55c. per lineal foot.

LEAVENWORTH, KAN.—The following bids for building hospital for Western Branch, N. H. D. V. S., were received by Colonel E. F. Brown, Inspector General: Holtzclaw Bros., Washington, D. C., for building complete, including heating and plumbing, \$98,500; T. H. O'Neil, Wichita, Kan., for building complete, including heating and plumbing \$95,300; James H. McGonigle, Leavenworth, for building complete, including heating and plumbing, \$92,789. The contract was closed with McGonigle.

BOSTON, June 11.—The Water Board opened proposals for furnishing cast-iron pipe and special castings required for Beacon Street, caused by a relocation and change of grade of said street, and also for the Cochituate service in East Boston. R. D. Wood & Co., of Philadelphia, bid \$35 per ton for 1,100 tons of 24-inch pipe, \$34.50 for 170 tons of 30-inch, \$34 for 450 tons of 48-inch, and \$74 per ton for 80 tons of special castings; the aggregate amount of his bid was \$65,585. A. H. McNeal Pipe Company, of Burlington, N. J., bid \$35.50 for 1,100 tons of 24-inch pipe, \$35 for 170 tons of 30-inch, \$35 for 450 tons of 48-inch, and \$70 to \$100.80 for special castings; the total amount of the bid of Mr. McNeal was \$66,812. The contract was awarded to R. D. Wood & Co.

MILWAUKEE.—The Board of Public Works let contracts June 8, as follows: John O'Neil, constructing 616 feet of brick sewer in Tenth Street, \$1,618.

Charles Røediger, laying 3,076 feet of sewer in Twelfth, Thirteenth, and Fourteenth Avenues, \$4,738.90.

Jacob Warner, laying 1,156 feet of pipe sewer in Eighth Street, \$1,473.90.

J. C. F. Brand, laying 1,177 feet of pipe sewer in Fowler, Eighteenth, and Nineteenth Streets, \$1,380.95.

J. C. F. Brand, laying 857 feet of pipe sewer in Summit Place, Cramer Street, and Bellevue Place, \$1,209.40.

John O'Neil, laying 753 feet of brick sewer in Farwell Avenue, \$2,658.09.

James Reynolds, laying 990 feet of brick sewer in North Water Street, \$1,831.94.

ALBANY, N. Y.—The contract for dredging 20,000 cubic yards of material from the river at Mull's, North Coeymans, has been awarded P. W. Myers, of Albany, at 16 3/4 cents per cubic yard, by the Superintendent of Public Works.

TOPEKA, KAN.—The State House Commission has awarded the contract for building the State Capitol to George H. Evans & Co., at \$422,000.

BOSTON, MASS.—Bids, in accordance with the advertisement of the Board of Directors for Public Institutions, for a supply of dimension stone at Deer Island, have been opened as follows: E. S. Chapen, Boston, edgestones 30 cents per foot, catch-basins \$6.08, \$6.70, \$7.75; Pigeon Hill Granite Company, Rockport, edgestones 37 cents per lineal foot, catch-basins \$5.90, \$6, \$5.90; Lanesville Granite Company, Lanesville, edgestones, 40 cents per lineal foot, catch-basins \$10.50, \$20, \$14.50; J. J. Horgan, Cambridgeport, edgestones 30 cents, catch-basins \$6, \$8, \$6; Rockport Granite Company, Rockport, edgestones 37 1/2 cents per foot, catch-basins \$5.75, \$6, \$6.

In accordance with the notice of the Superintendent of Streets, proposals were opened June 11 for furnishing and delivering 4,000 cubic yards, more or less, of crushed stone, on Washington Street, West Roxbury District, between Forest Hill Station and Ashland Street. Owen Nawn was the only bidder at \$2.20 per cubic yard, and the contract was awarded to him.

NEW YORK CITY.—Bids were opened at the Department of Charities and Correction on Tuesday, June 14, for alterations and additions to the Retreat at Blackwell's Island and for the construction of a pavilion to relieve the almshouse. For the Retreat, bidders, Joseph Spears, \$39,090; John H. Deeves & Bros., \$40,900.

Pavilion, bidders, John H. Deeves & Son, \$20,750; Thomas Ovington, \$22,823; James H. Brady, \$39,462.

Also for repairs to steamer "Minnahamock" as follows: C. & R. Poillon, \$1,771.40; M. Theriault, \$1,175; John F. Walsh, Jr., \$1,194; N. F. Palmer, Jr., & Co., \$1,952; Jenkins & Tregarten, \$1,325. No awards have as yet been made.

NEW YORK CITY.—Bids were opened at the Department of Docks, on Thursday, June 16, for preparing and building a new wooden pier at the foot of West One Hundred and Thirty-second Street, North River; for preparing and building a new crib bulkhead at and south-westerly of West One Hundred and Thirty-second Street, North River, and for repairing the crib bulkhead northerly of the crib pier at the foot of One Hundred and Thirty-second Street, North River. The following were the bidders:

John M. Monks, New York, dredging, per cubic yard, 25c.; new crib bulkhead complete, \$11,094; repairs to existing crib bulkhead, \$2,196; new wooden pier complete, \$17,452; total, \$33,367.

John W. Flaherty, New York, 28c.; \$11,875; \$2,800; \$19,775; \$37,300, respectively.

O'Connell & Coffey, Brooklyn, 28c.; \$10,875; \$2,175; \$15,583; \$31,573, respectively.

Joseph Walsh, New York, 28c.; \$11,500; \$2,718; \$18,700; \$35,858, respectively.

John Gillis, Brooklyn, 20c.; \$11,469; \$1,841; \$17,918; \$33,328, respectively.

Award not yet made.

The following bids were also opened—for preparing and building a crib-work bulkhead at the foot of East Seventy-sixth Street, East River:

John W. Flaherty, New York, total, \$5,300; O'Connell & Coffey, Brooklyn, total, \$4,945; Joseph Walsh, New York, total, \$6,000.

LEAVENWORTH, KAN.—The following bids for two iron

Board of County Commissioners, June 5: Kansas City Bridge and Iron Company, Kansas City, Mo., Walnut Creek, \$4,399; Kansas City Bridge and Iron Company, Kansas City, Mo., De Soto Road, \$4,274; Wrought Iron Bridge Company, Canton, Ohio, Walnut Creek, \$6,800; Missouri Valley Bridge and Iron Company, Leavenworth, Ohio, Walnut Creek, \$4,300; Missouri Valley Bridge and Iron Company, Leavenworth Kan., Five-Mile Creek, \$2,200. Bids rejected as being above estimate.

BROOKLYN.—Bids for building twenty-seven buildings at the County Farm at Saint Johnland were opened by the County Commissioners, June 16, as below: P. J. Carlin, \$890,000; James Birkett, \$934,530; Edward Freely, \$906,000; James & Taylor, for erecting three buildings, \$88,350. All bids were referred to the Committee on Contracts.

Bids for lighting the County Farm by electricity were received from Williams & Potter, who agreed to supply everything in connection therewith for \$38,300, and the Edison Manufacturing Company agreed to do the same for \$37,000.

SAN DIEGO, CAL.—Contracts for pipe, cement, etc., were awarded to the following bidders: Ditching 20,000 feet to J. John drew for \$10,000. Pipe—San Francisco Sewer-Pipe Association, from 21 cents to \$8 per lineal foot, according to size and quantity. Cement—W. W. Stewart, at the following prices: Portland and K. B. \$3.90, Gillenham \$3.80, and Eagle \$3.75 per barrel.

CAMDEN, N. J.—The following bids have been received for the 10,000,000-gallon pump for the Camden Water-Works: George F. Blake Mfg. Co., New York, \$32,400, \$35,500, and \$45,000; Dixon Manufacturing Company, Scranton, \$67,500; H. R. Worthington, New York, \$30,750, and \$19,275; Davidson Steam-Pump Company, New York, \$34,800 and \$28,000, and Holly Manufacturing Company, Lockport, \$39,500 and \$29,500. The bid of the George F. Blake Co. for \$35,500 has been accepted.

GOVERNMENT WORK.

ABSTRACT of bids for timber, iron, and stone, at the harbors of Buffalo, Dunkirk, Oak Orchard, Olcott, and Wilson, N. Y., and Erie, Pa., opened May 16, by Captain F. A. Mahan, U. S. Engineers, at Buffalo:

Buffalo Harbor.—Laycock Lumber Co., Buffalo, 1,272 lineal feet of piles, 25 cents per foot; 5,728 feet, B. M., \$26 per M.; 119,728 feet, B. M., of white pine, \$25 per M.

G. Elias & Bro., Buffalo, 25 cents, \$24, \$21, respectively; contract awarded.

Beals & Brown, Buffalo, 3,466 pounds of drift-bolts, 3.1 cents per pound; 450 screw-bolts, 50 cents each; 8 kegs of spikes, \$4.87 per keg.

Daniel McNaughton, Buffalo, N. Y., 2.2 cents, 55 cents, \$4.60; contract awarded.

Dunkirk Harbor.—Beals & Brown, 24,286 pounds of drift-bolts, 3.1 cents per pound; 180 screw-bolts, 40 cents each; 29 kegs spikes, \$4.87 per keg.

Daniel McNaughton, 2.7 cents, 48 cents, \$4.55; contract awarded.

Laycock Lumber Co., 254,280 feet, B. M., of hemlock, \$10 per M.

G. Elias & Bro., \$10.50; contract awarded.

Oak Orchard.—Laycock Lumber Company, 274,560 feet, B. M., of white pine, \$25 per M.

G. Elias & Bro., \$25 per M.

Miles S. Vosburgh, Wilson, N. Y., \$24.90 (contract).

Beals S. Brown, 17,000 pounds drift-bolts, 3.4 cents per pound; 17 kegs spikes, \$5.25 per keg.

Daniel McNaughton, 2.9 cents, \$4.80 (contract).

George M. Waterman, Albion, N. Y., 3 cents, \$5.50.

Miles S. Vosburgh, 1,043 cubic yards of stone, \$1.25 per cubic yard.

Owen & Calvert, Youngstown, N. Y., \$1.80.

Hannibal S. Sethermer, Carlton, N. Y., \$1.15 (contract).

Olcott.—Laycock Lumber Company, 131,768 feet, B. M., of white pine, \$25 per M.

G. Elias & Bro., \$25 (contract).

Miles S. Vosburgh, \$24.90 (contract).

Beals & Brown, 9,700 pounds drift-bolts, 3.4 cents; 10 kegs spikes, \$5.25.

Daniel McNaughton, 2.9 cents (contract), \$4.80 (contract).

Miles S. Vosburgh, 474 cubic yards of stone, \$1.22 per cubic yard (contract).

Owen & Calvert, \$1.55.

Wilson Harbor, N. Y.—Laycock Lumber Co., 22,488 feet, B. M., of white pine, \$25 per M.

a., propose to put in a \$125,000 blast furnace here. The citizens' meeting has urged the City Council to furnish bonus.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 4. } PUBLISHED EVERY SATURDAY.

NEW YORK, JUNE 25, 1887.

LONDON, JULY 9, 1887.

SINGLE COPIES, TEN CENTS. } IN AMERICA
Subscription, \$4.00 per year in advance, post paid. }
SINGLE COPIES, SIXPENCE. } IN GREAT
Subscription, 20s. per annum in advance, post paid. } BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

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OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

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Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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SOCIETY PUBLICATIONS.

THE Royal Institute of British Architects has a very admirable regulation to the effect that it will not publish matter in its "Transactions" which has previously appeared in print. The consequence is that the "Transactions" are sought for, and nearly always have some good original matter interesting to the architect. The third volume, recently received by us, is no exception to the rule. In reading it one is struck with the variety of topics which can profitably employ an architect, and with the number of good themes which can be found in the most unpromising fields. Thus, a paper by William Simpson on "Mud Architecture" develops a quantity of interesting facts collected during a trip through Persia and other countries. His paper is quite as interesting as a record of travel as it is in the light of an architectural document, and he supplements it with a number of notes on Mud Architecture as practiced in other countries besides Persia. He claims to have established the fact that the Great Wall of China was in part, at least, built of mud, or sun-dried clay cemented with mud, which amounts to the same thing, and he traces the use of mud as a building material through Greece, Egypt, nearly all the countries of Europe, England, America, and clear to San Francisco. It will cause many readers considerable surprise to find the extent to which mud is still used. In the south of France *pisé* construction is generally adopted for ordinary dwellings, and in England what is known as cob-walls are used all through Devonshire. In our own country we know that adobe is in quite common use in the West; indeed, the oldest building erected by Europeans in America is the church at Santa Fé, built entirely of mud, which celebrated its three hundredth anniversary some five years ago.

Another interesting paper records the notes of a tour in Greece, by Professor Lewis—interesting at least to those who are at all familiar with the country, though it goes into details to a degree that renders it rather fatiguing to the ordinary reader.

But the paper which to our mind seems of the greatest value is one by Professor Kerr on the "Architect's Functions in Relation to Building Contracts." It is a very clear-headed view of a difficult problem—one that is very seldom treated at all in theory, and is exceedingly difficult to elucidate in professional practice. We cannot do better than to quote his words directly, especially as his remarks apply with almost equal force to engineers and to architects:

"The proprietor or employer desires and expects two things: first, to get his work done with all proper economy; secondly, to know beforehand what money he must provide. Both these expectations are quite reasonable, for the architect and the quantity surveyor are paid expressly to realize them. But at the same time we all know that in both cases the principle is liable to abuse.

"When the proprietor is allowed to overstrain economy he overstrains the contract, and anything that is overstrained, no matter what it is, must sooner or later snap. When he goes even further than this, and hopes to secure a contractor who has made an unwary reckoning, and means to hold him to the grindstone of a losing bargain, he is (in my humble judgment)—let commercial law say what it may—contemplating something like a fraud; and in such a case, not only ought the sanction of the architect to be refused on the ground of honor, but both architect and client will do well to remember that there exist in-

flexible natural laws by whose silent operation the offender is not unlikely to find that grindstones grind both ways.

"You all know how often extras spring up like weeds in the field, in spite of precautions, so that the only way to avoid them hopefully is to recognize them fairly and make allowance for them—not scientifically, of course, but by some rule of thumb, which will answer quite as well; acknowledging in this way the principle that, so far as prudent and experienced advice and warning can accomplish the object, the client is really entitled to feel that the contract which he is advised to sign will cover the actual expense of his project."

That is surely to the point, and here is another good statement:

"In connection with such a complex case as that of a building contract the bargain in which one party has the advantage of the other, whether by design or by accident, is very likely to turn out a bad bargain for both alike. Speculative conditions, therefore, whose object is to impose upon the contractor unknown risks for which it would be idle to suppose that he has provided an adequate allowance, are essentially unsafe conditions."

How many of our architects would take such a view of the case if compelled to arbitrate between a gouty owner and a quarrelsome contractor? Professor Kerr's general view of the subject is, of course, taken from the architect's standpoint, but it is so fair-minded and free from prejudice, we can only regret that it is not more universally received and more fully lived up to by the profession on this side of the water. The principles he enunciates are worthy of remembrance by every architect who is called upon to settle disputes about a building.

"I am proud to be able to stand up in this assembly and repeat my proposition that the confidence with which building contractors are obliged to leave their fortunes to the good faith of the architectural professions is seldom abused; exceptions at any rate prove the rule."

"I come now to the end of my argument, and having regard to all the various incidental circumstances in which I have represented the architect as having to deal with building contracts, I have to submit that what I call liberality, loyal justice to all concerned, impartiality that is warm and sympathetic as distinguished from impartiality that is frigid and dead, is the best, strongest, and safest policy for him to pursue; avoiding harshness of every kind, and especially punitive harshness, as the province of the lawyer alone; and impressing upon his every word and act the mark of that generous fair-dealing (as distinguishable again from ungenerous fair-dealing) which underlies not only the traditional dignity of his vocation, but the personal position of almost unparalleled confidence which he is accustomed to occupy by general consent."

MILWAUKEE GARBAGE.

JUDGING from recent articles in the Milwaukee daily press, that city is rather behind the times in the matter of disposal of its garbage. It seems that this refuse matter has heretofore been disposed of by burial in the outskirts of the city, but that the local health authorities of the neighboring towns have declared this to be a nuisance and have forbidden its continuance, which under the State laws they have a right to do.

The city authorities have resorted to the plan of dumping the garbage into the lake and are thus running the risk of contaminating the water-supply as well as creating a small local nuisance, since the dumping-scow is only to be towed out every other day. The proper method of dispos-

ing of this refuse—namely, by burning it in a properly arranged furnace—does not seem to have received any consideration.

OUR BRITISH CORRESPONDENCE.

Water-Works for a District of Liverpool—Stagings at the Northern Railway Terminus—Sugar Saturated with Sewage—Healthfulness of New Blaydon, Northumberland—Basic Slag as a Manure—Pneumatic Tubes in Newspaper Offices.

LONDON, June 8, 1887.

NEW water-works have been inaugurated in the Wirral district of Liverpool, which has hitherto been dependent on a hand supply. A tower, 58 feet high, with wrought-iron tanks 30 feet in diameter by 35 feet, capacity of 100,000 gallons, has been erected on Heswall Hill. The water is pumped to this water-tower, a distance of four miles, and is supplied thence to the town through a 6-inch main.

one of the sewers. A portion of the cargo was saturated with the water and sewage contained therein, notwithstanding which the Medical Officer of the district permitted it to be put on the market. If the statement is incorrect, it is well that Dr. Davies should have the opportunity of contradicting it, but the information is given to me from a reliable source.

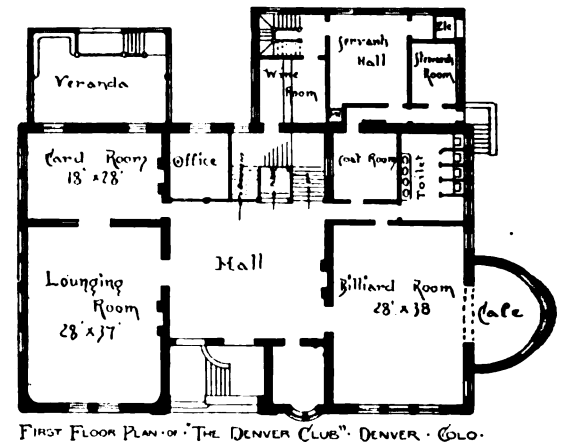
According to the *Sanitary Record*, the Medical Officer of Health of New Blaydon, Northumberland district, has a complaint against the people under his charge of being so distressingly healthy. At a meeting of the Local Board, he stated that he had nothing whatever to report of local interest, the state of health being fully maintained and altogether remarkable. He stated he might fairly claim to join in the doleful and too general cry of, "Yes, indeed; trade is very slack." This gentleman is to be congratulated.

The paper on Basic Slag as a Manure, read by Mr. Gilchrist before the Iron and Steel Institute, has aroused considerable attention amongst iron and steel masters.

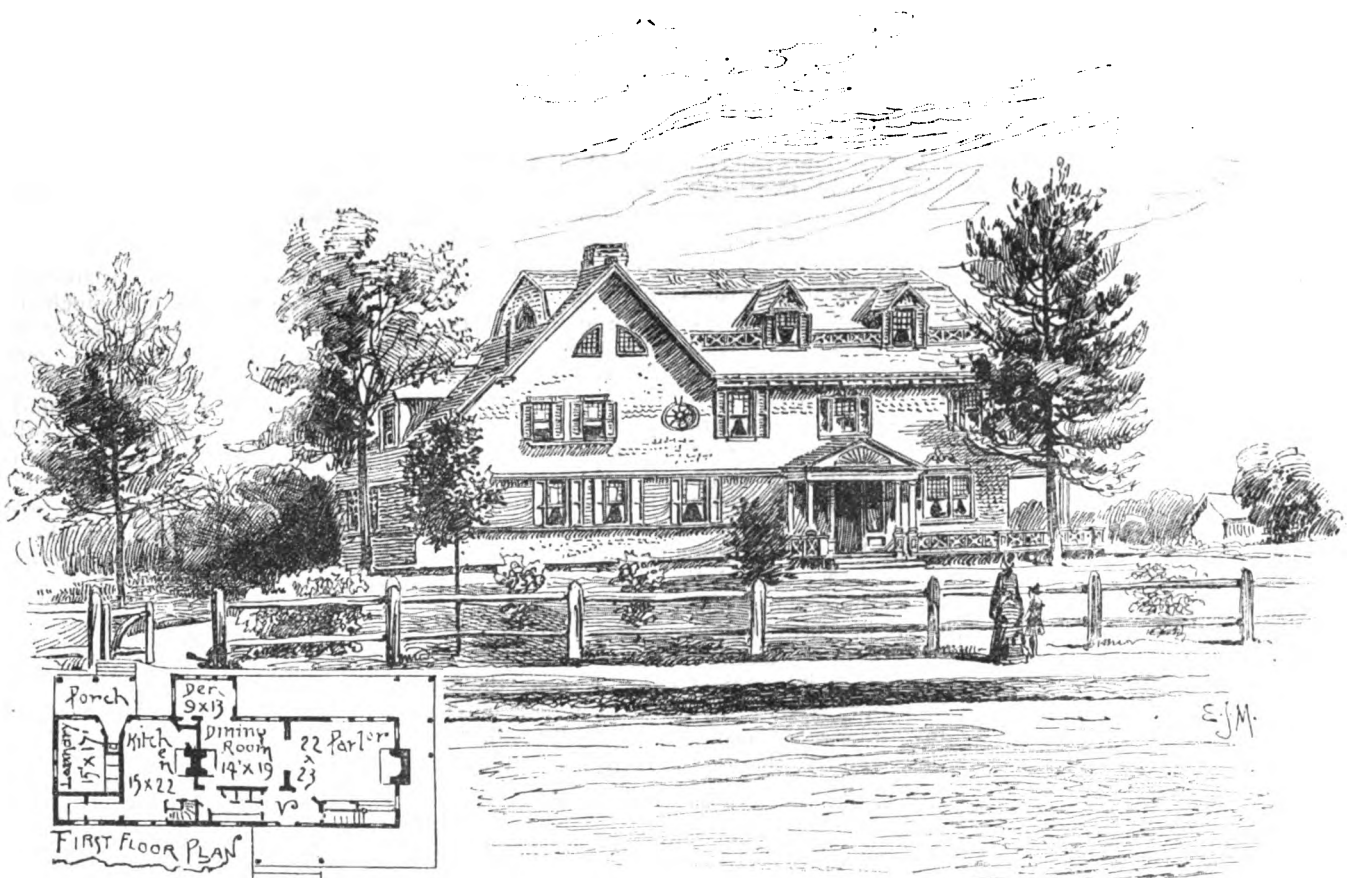
OUR SPECIAL ILLUSTRATION.

DENVER CLUB HOUSE.—VARIAN & STERNER, ARCHITECTS.

THE subject of our special illustration this week, is the new club-house of the Denver Club, at Denver, Colorado.



FIRST FLOOR PLAN OF "THE DENVER CLUB," DENVER, COLO.



RESIDENCE OF FREDERICK SCHENCK, LAWRENCE, L. I.—LAMB & RICH, ARCHITECTS.

In connection with the reconstruction of the roof of the station at the Great Northern Railway Terminus, King's Cross, the method of staging adopted by Messrs. Andrew Handyside & Co., of Derby and London, commends itself both on the grounds of economy and simplicity. The entire existing roof had to be taken down and replaced with another of lighter construction. The work was done in sections. On the main platform on either side two heavily-built railway trucks, to run on continuous rails, supported a perpendicular staging, which was connected horizontally immediately under the roof. There are some six lines of metals abreast, together with platforms, in the station. When one section of the roof had been attended to a further section of rail was laid in front of the truck, the staging moved forward *en bloc*, and the next section taken in hand. The work has thus proceeded without the slightest interruption to the regular traffic.

The problem presents itself as to whether sugar saturated with sewage is a wholesome commodity to put upon the market. I hear that a vessel with a cargo of sugar sunk in the river at Bristol, immediately outside the outlet of

Insistence is placed on the point of fineness of the powder necessary before use. It is stated that an artificial manure company has undertaken to purchase any quantity of the artificial preparation which can be supplied by an iron company in the North, laying itself out for the manufacture, by whom the powder is rendered so fine that it passes through a mesh 10,000 to the square inch.

The Manchester telegraph office, and the *Sunday and Sporting Chronicle* office have lately been connected by pneumatic tubes with a view to more rapid receipt of press news. The distance is 420 yards, and the tube is lead-lined iron pipe, 1½-inch bore. Vacuum, 15 to 20 inches, is created in a steel chamber in the newspaper office by a set of 8-inch air-pumps. When a message is received at the telegraph office it is enclosed in a felt "carrier" and inserted in the tube; the newspaper office is signalled by electric bell and the suction is turned on. Time of transmission is stated at 10 seconds.

TV-VALVE.

It is built of gray and brown sandstone, with tile roof. Interior in hard woods, walls in leather, and "combed work." The architects were Varian & Sterner, of Denver.

OUR VIGNETTE ILLUSTRATION.

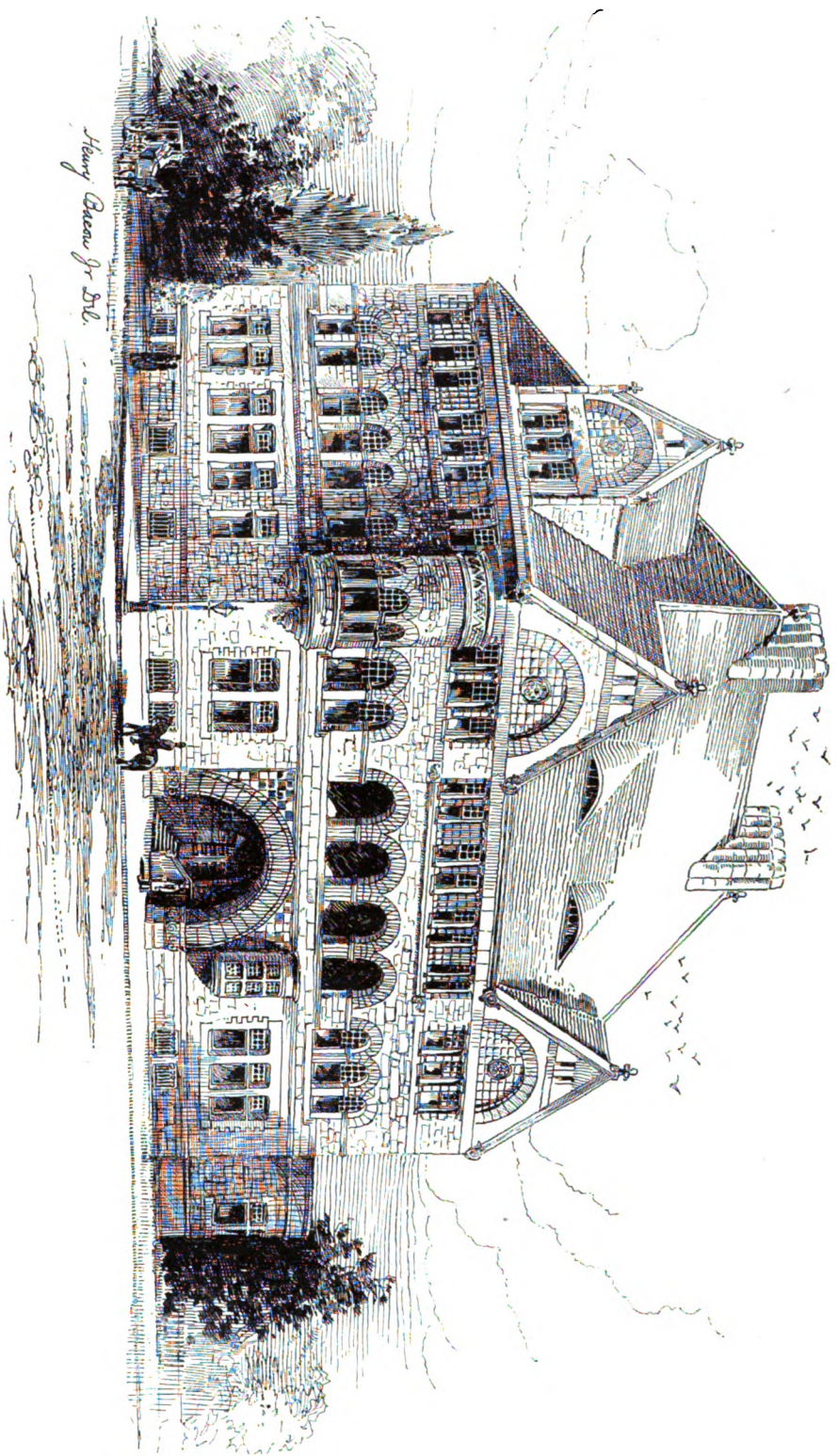
A HOUSE AT LAWRENCE, L. I.

THE subject of our vignette illustration is the residence of Mr. Frederick Schenck, at Lawrence, L. I. The house is frame, shingled. Inside finish old colonial, painted in light colors. Parlor white and gold. The architects were Lamb & Rich, of New York.

OUR DETAIL SHEET.

OUR detail sheet, the twelfth in the series, shows a store front at 1022 Walnut Street, Philadelphia. Wilson Eyre, Jr., architect.

A BILL has just been signed by Governor Hill which allows the gas companies to charge \$1.60 per 1,000 cubic feet for gas in the annexed district of New York City.

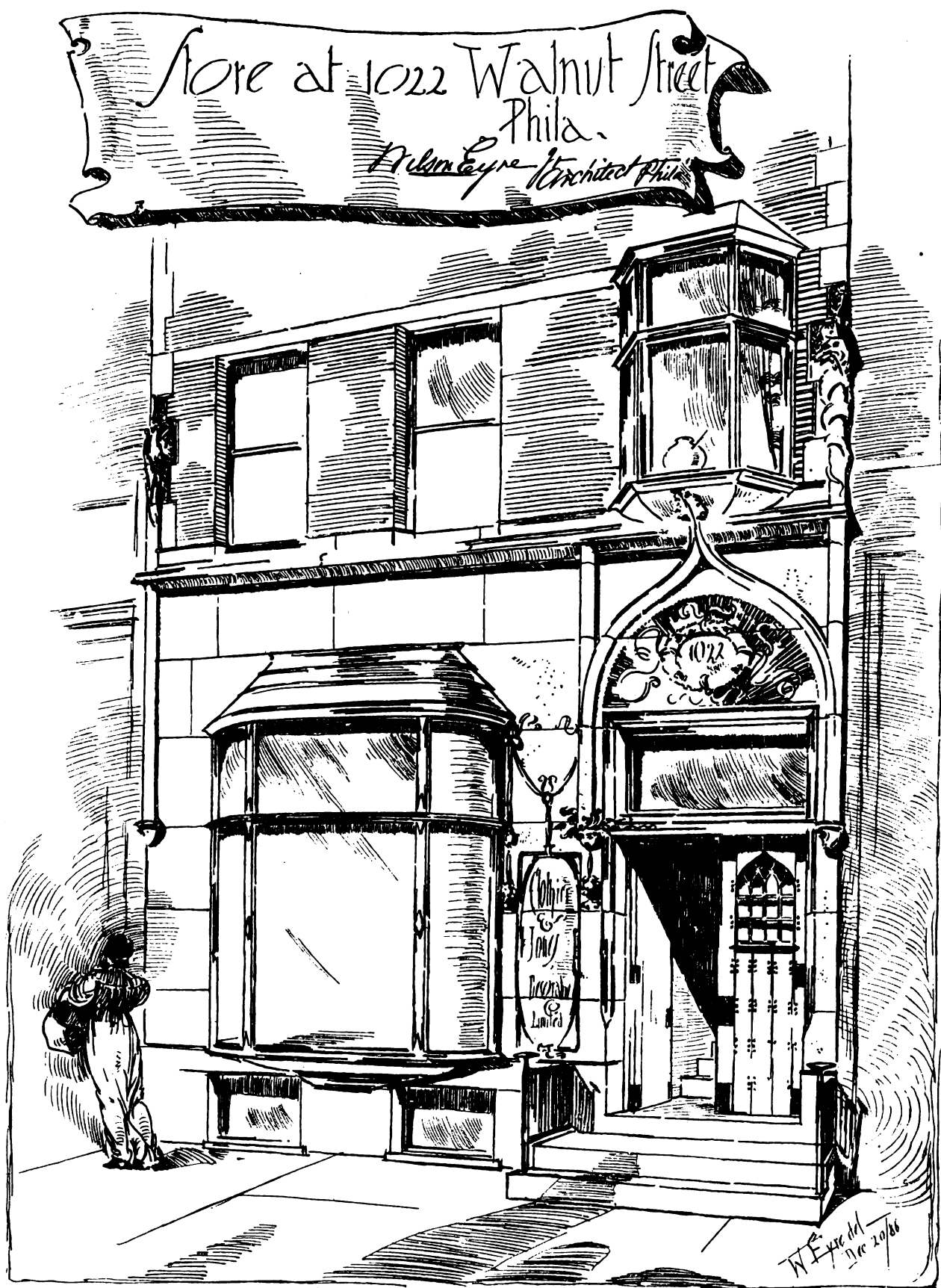


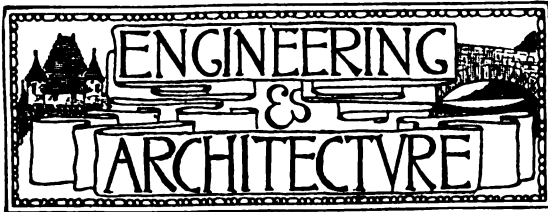
THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

THE DENVER CLUB, DENVER, COL.

VARIAN & STERNER, ARCHITECTS.

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WATER-WORKS OF THE EAST ORANGE AND BLOOMFIELD WATER COMPANY, NEW JERSEY.

THESE works are situated on Grove Street, about one and one-half miles northerly from the Grove Street Station on the Delaware, Lackawanna and Western Railroad. In connection with the subject of obtaining a water-supply from wells, these works possess especial interest from the fact that the water does not come through the soil, but from the rock below, and evidently has its source at some distance. The State Geologist, Professor G. H. Cook, thinks the source is the Orange Mountain, about three and one-half miles distant to the west. The elevation of surface at the site of the wells, according to the topographical maps of New Jersey, is about 100 feet above tide, while the elevation of the mountain is about 650 feet.

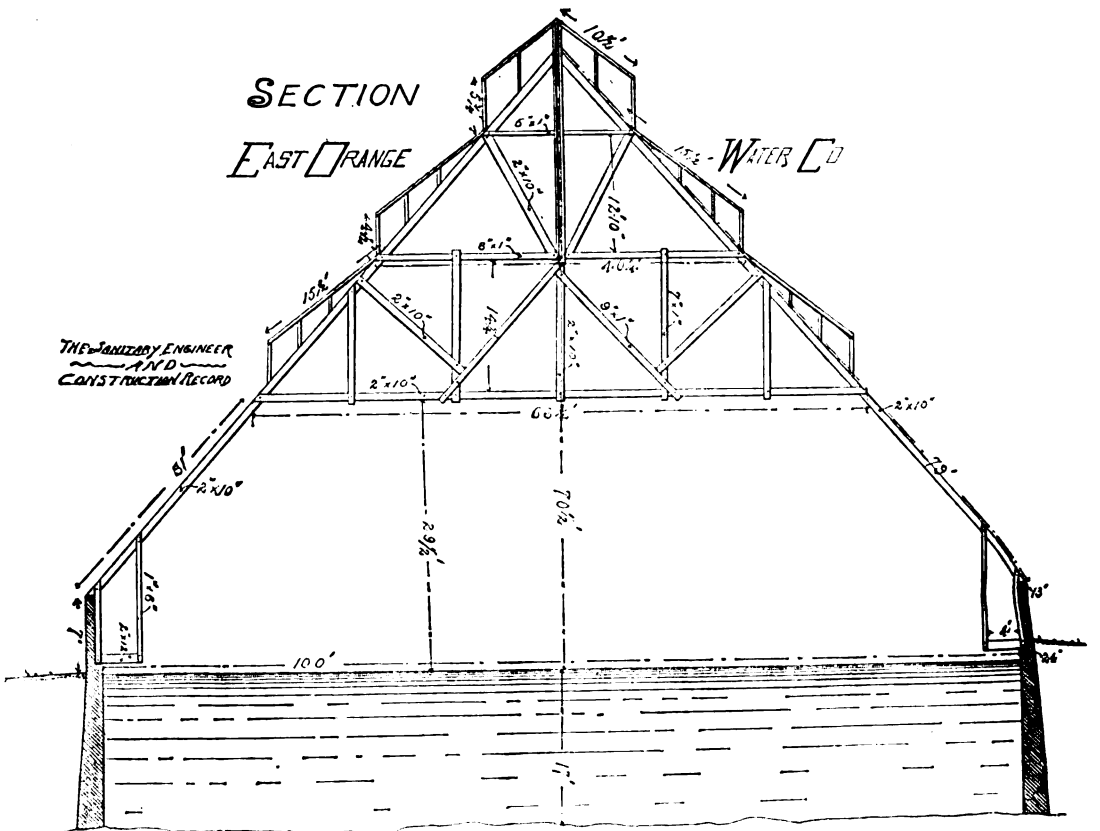
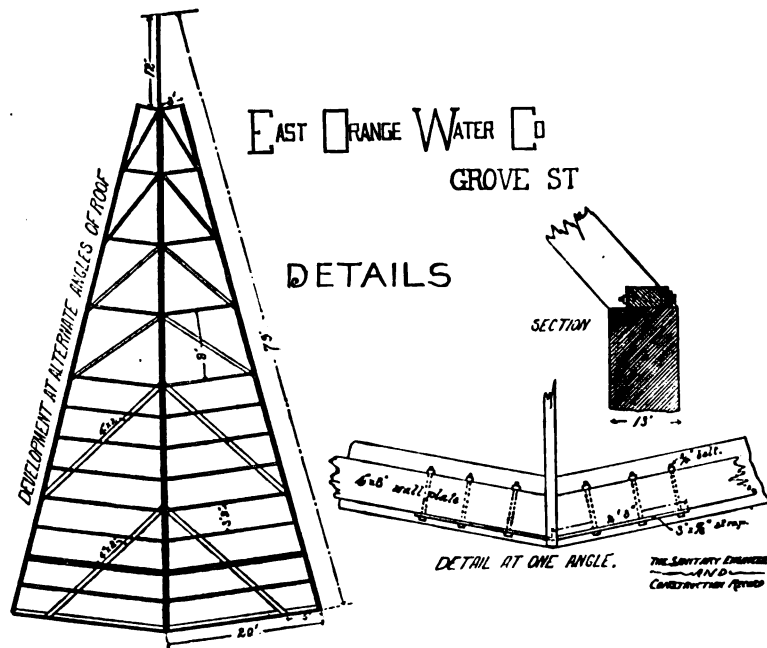
The pumping-station is situated in the valley, which is some fifteen feet lower than the road and 200 feet distant.

The pumping-engines are a Gaskill compound duplex condensing engine, with 10-inch and 20-inch steam and 12-inch water-cylinders, with 18-inch stroke, with an estimated capacity of $1\frac{1}{2}$ million gallons per day. Also, a Worthington duplex compound, with 12-inch and 18-inch steam and 14-inch water-cylinders, with 10-inch stroke, and a capacity of $1\frac{1}{4}$ million gallons. Either set is capable of supplying more than double the present requirements of the service, which are from 360,000 to 500,000 gallons. The supply is by direct pumping through two independent lines of 8-inch mains. The pressure for domestic service is 70 to 75 pounds and for fire service 125 pounds.

The grounds in which the wells are located was originally swampy, with a sluggish stream running across it. Mr. J. M. Randall, the Vice-President of the company and the designer of the works, began examining the site for water in 1883, by putting down a 6-inch tube-well to a depth of 95 feet. The water rose in this to within 5 feet of the ground surface. This well is inside of the pump-house. A second well of same size was next put down to same depth at 200 feet north of the first, followed by a third one at about the same distance south. These when connected up furnished a supply of 350,000 gallons a day. The third pipe-well was put down to 110 feet depth, and the water was found to be harder than was desirable, this hardness seeming to increase with the depth.

Ten acres more of property were then bought, and a well 25 feet in diameter was sunk a short distance east of No. 1 to a depth of 20 feet; this being about 10 feet into the bed-rock below. It was connected with the pumps by a 12-inch suction and yielded on a test about half a million gallons per day. The curb was a 20-inch cemented stone wall, tightly joined to the rock below, surmounted by a 12-inch cemented wall above, so as to shut out the surface and the ground water.

In 1884, No. 5 well, fifty-two feet in diameter and twenty feet deep, was sunk at about 600 feet from No. 1. This went eleven feet into the rock and will yield 1,000,000 gallons in twenty-four hours. It has been drawn upon continuously for six months at the rate of 500,000 to 600,000 gallons. The large well, No. 6, was put down in 1886, and is located about 700 feet from the pumping-station. It is 100 feet inside diameter and twenty-three feet deep, being sunk about twelve feet into the rock. The stone wall up to about the ground surface is thirty inches thick, and the brick wall above the eaves above is eight feet high and twelve inches thick. The building is a polygon with sixteen sides, each of twenty feet four inches external measurement, with a projecting entrance at one side. The height of the building over the well to the peak is about sixty feet, and the roof is in four slopes, with louvres covered by netting on the vertical faces between for ventilation. The roof-timbering is exceedingly light, but, being braced and tied in every direction, seems to stand well. It springs from wall plates 4x8 inches, the 2x12-inch rafters springing from the wall-plates at the angles and running continuously to the peak. The alternate rafters have light 4x2-inch diagonal braces in pairs at intervals all the way to the peak. The purlines are 10x2 inches, placed, with one exception, the



broad way at right angles to the rafters and at spaces of about three feet. At the top of the third slope of the roof each of the sixteen angles is tied by horizontal wooden ties, intersecting and joined at the centre. At the top of the second slope the alternate angles are tied by similar single and double ties. Braces are also run from the centre of these to the top of the lower slope of the roof. Vertical struts are also inserted as shown in the annexed section of the building, to make this bracing effective, and wherever a brace is lacking in lateral stiffness, cross-bracing and tying are resorted to, the result being, as stated, an exceedingly light roof.

The thrust at the angles of the wall-plates is taken up by wrought-iron straps $3\frac{1}{2} \times \frac{3}{4}$ -inch and 4 feet 6 inches long, bent to the angle and bolted to the exterior faces of adjacent sticks by $\frac{3}{4}$ -inch bolts, three in each end of each stick. A gallery, four feet wide, runs entirely around the inside of the building, and is hung up to the purlines by three $2 \times \frac{3}{2}$ -inch sticks opposite each face of the polygon. The purlines to which they are attached are doubled in thickness and placed vertical to be in position to sustain the load. The building is certainly very unique in appearance and seems well fitted for its purpose.

The water stands in the well at about eighteen feet depth, and is remarkably constant no matter what the weather may be, and when not pumped from heavily the water in all three open wells rises about three feet above the ground surface. The well No. 6 is connected with No. 4 by an 8-inch syphon pipe (since the ground descends between the two), and it therefore serves as a reservoir to be drawn

upon when No. 4 is reduced enough to cause a flow between them. Its storage capacity is nearly 1,500,000 gallons.

As a proof that the water does not come from the surface soil, the following statement is made. When No. 6 was being built the supply was drawn from No. 5 for five months constantly. For fourteen weeks of this time, while excavation was progressing, the pumps at No. 6 were kept running night and day to keep the water down so that the men could work, as it would submerge the work if pumping ceased but a few minutes. During the whole of this time the water stood in No. 4 at the full height, and without perceptible fluctuation.

The water seems to come in everywhere over the surface of the rock from seams and fissures in the red sandstone foundation. The rock is of a shaly character, brownish red in color, some layers being hard and resisting the weather, and others crumbling to pieces.

The capacity of No. 6 is estimated at $1\frac{1}{4}$ millions per day.

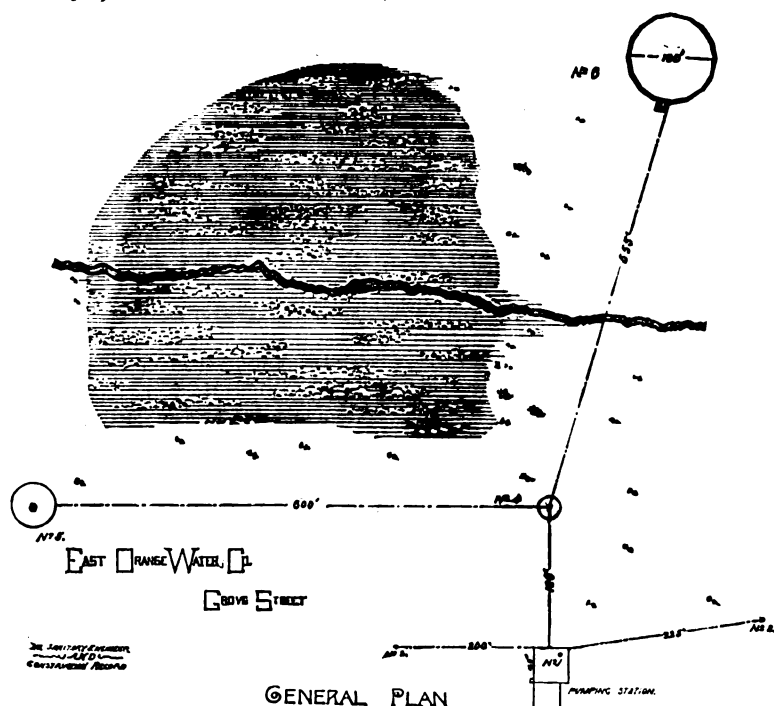
The fact that the water grows harder at a greater depth was determined also by the borings at the Licorice Works on Bloomfield Avenue, in Newark, about three-fourths of a mile away to the east of No. 6 well. A 6-inch pipe was sunk 25 feet at a time to a depth of 100 feet, and the water tested at different depths, with the result that the best water was found at 25 feet from the surface. There are 75,000 gallons pumped per day from the well.

As to the quality of the water furnished by the East Orange Company, its temperature is 50° Fah. in summer

and 47° in winter. An analysis by Prof. Cook showed absolute freedom from organic matter, a hardness equivalent to calcium carbonate 5.091. Total solids in grains

THE COLLAPSE OF THE DERRICK AT THE BROOKLYN NAVY YARD.

A 75-TON derrick collapsed while being tested at the



per gallon of 9.838, of which $2\frac{1}{4}$ grains were volatile (carbonic acid). The remainder were as follows:

	Grains.
Chlorine as chlorides.....	0.857
Sulphuric acid	0.379
Silica	1.230
Iron and alumina	0.046
Lime	2.209
Magnesia.....	0.712
Soda	1.936
Potash.....	0.227
Total	7.596

A CREMATORY COMPETITION.

THE Society of Architecture of Lyons has selected as the subject of its annual prize competition a crematory in the form of an appropriate monument to be erected in a cemetery. The structure with its surroundings and annexes must not occupy more than 2,000 square metres. It is to contain an anteroom and chapel, and beneath these a crypt into which the bier is to descend after the last funeral services. In this crypt space is to be provided for the cremating furnace, the chimney of which should be the chief motive of the building.

Besides the opening for the descent of the bier, two doors are to be provided to the crypt, one for the entrance of the relatives of the deceased, the other, which should be inconspicuous, for the employees of the establishment. Competitors need not pay attention to the particular form of furnace to be used; they have only to provide sufficient space for it in the central part of the crypt. Around the crypt provision is to be made by galleries and niches for about 5,000 urns, each occupying 0.120 of a cubic metre. There are required plans of each floor on a scale of 1 to 100, a general elevation, an elevation of the principal front, and a section of this front on a scale of 2 to 100. Competing plans must be sent to the "Secrétaire de la Société d'Architecture, au Palais des Beaux-Arts, Lyons, France," before November 31, 1887. The decision will be made by a committee of seven members of the society chosen by ballot. The prizes consist of a gold medal and a silver medal. They will be awarded in February, 1888.

CLEVELAND, O., ENGINEERS' CLUB.

At the meeting, June 14, Professor Stockwell read a paper on the "Use of the horizontal telescope for determining differences of latitude and longitude." Mr. William H. Searles presented the report of the committee on revision of the constitution. The matter will be considered further. It was decided to obtain and frame photographs of the President and ex-President, which will be hung in the club room.

THE graduation exercises of the Rensselaer Polytechnic Institute, at Troy, were held June 15. The class graduated forty civil engineers and two bachelors of science.

Brooklyn Navy Yard on June 15. The full particulars of the accident could not be obtained, nor was there much to be seen, as the pontoon on which the derrick stood was sunk. In general, the following may be said: The derrick was made from designs furnished by the Bureau of Steam Engineering, and built by The Pusey & Jones Company, of Wilmington, Del. It had been previously tested under certain conditions, and had lain at the Brooklyn Navy Yard for some months, when a board of officers was appointed by the Secretary of the Navy, with directions to test, first, what the derrick would lift up to the limit called for in the specifications—viz., a load of 75 tons lifted with the traveler at a distance of 33 feet from the end of the pontoon on which the derrick stood; second, to test also what the derrick would safely swing.

The derrick was of steel throughout, and of T-form, made up of a high, pyramidal, open-work standard of steel I-beams and ties and a king-post boom pivoted at the centre on the top of the standard. In plan the boom was a lozenge-shaped truss, with peripheral tension member, the longer diagonal being made up of two box-beams carrying a traveler between them. The box-beams were not continuous, but notched at the centre into a ring encircling the king-post pivot; two short struts butting also against the ring formed the co-ordinate diagonal of the lozenge.

The derrick was mounted on a pontoon secured by guy-ropes to the dock wall; the arm of the derrick, to which the weight was to be attached, was 61 feet from pivot to end, and projected over the dock wall about 40 feet, the counter-arm being secured by guys to the pontoon. At the end of the pontoon, away from the wall, were three ballast tanks into which water could be pumped as a counterpoise for the load lifted. The pontoon was also heavily ballasted with kentledge, laid in cement, on its bottom.

Before the accident took place, graded weights were lifted by the steam-hoist operating the derrick, and the effects on the stability of the pontoon were noted and its equilibrium preserved by pumping water into the ballast tanks. At the time the accident occurred the weight had been increased to 72 tons with the traveler 51 feet from the axis of the derrick and 33 feet from the front of the pontoon. The load had not quite cleared the ground when the pontoon dipped forward and listed to one side, throwing the derrick considerably out of the vertical, and, at the same time, it is believed the horizontal, peripheral tie of the boom-truss parted on one side, and the box-beams swung around to the side toward which the pontoon listed and dropped into the water with the rest of the boom and tackle. The pontoon, relieved of the weight at the dock end, plunged under water at the stern and finally sank, but without being overturned.

Efforts are being made to raise the wreck, when the cause of the accident will probably be definitely determined.

THE REPAIR AND MAINTENANCE OF ROADS.

BY W. H. WHEELER, M. INST. C. E.

FROM the *L. A. W. Bulletin* we abstract from an article, especially written for the National Cyclists' Union, some very pertinent remarks on the subject of road repairing and maintenance. The roads in many parts of our country are a disgrace to civilization, and it is undoubtedly true that an immense saving in money would result if their management would be left to the intelligent direction of educated engineers, instead of the ignorant roadmasters who consider a road made when it is heaped up in the middle:

"Although railways may have altered the character of the traffic on the common roads, the actual number of vehicles and amount of produce conveyed over them is no doubt greater than it ever was. The railways, by facilitating traffic, have greatly increased the resources of the country, but every ton of goods conveyed by railway must first pass over the roads leading to or from the place of production.

For economical and convenient traction, roads should be maintained in thoroughly good order. This, however, is too seldom the case, and many roads are kept in such a condition as to be a disgrace to the country.

This is the more inexcusable as it is a fact well known to all who have had experience in the matter, that roads well maintained and kept in good order cost less than bad roads. It is plain that if by keeping roads in good order, four horses are enabled to do the work of five, or three of four (by no means an unreasonable supposition), the economy of horse labor and wear and tear of vehicles and harness must be considerable, but economy in the actual cost of maintenance generally follows as well. Experience proves that a road with sufficient strength, good surface, and thorough drainage can be kept in first-rate order with a much smaller quantity of materials than an inferior, ill-kept road requires, and, though a greater amount of manual labor may be necessary, a good road on the whole is generally more cheaply maintained than a bad one, especially when there is any considerable amount of traffic. The indirect saving in the cost of traction and wear and tear of vehicles and horses, which would result from better roads, would probably far exceed any direct saving in expenditure on the roads."

It is estimated that the saving in England by improving the roads (and they are now greatly better than in this country) would be \$100,000,000 per year. This is on the supposition that three horses would be able to do the work of four. It is no exaggeration to say that on many of the roads in this country one horse would do the work of two were the roads put in good condition. The author, referring to English experience, quotes a case where the tolls on a turnpike were insufficient to pay expenses, but by a reorganization of the labor system and the selection of good materials, not only was the roadbed so much improved that the loads hauled were doubled, but the income paid off the debt.

To accomplish this, however, requires the supervision of a skilled engineer, and this is the rock on which authorities here are sure to come to grief, since every roadmaster is his own engineer.

There is no point upon which a more decided coincidence of opinion exists among all those who profess what may now be called the science of roadmaking, than that the first effectual step toward general improvement must be the employment of persons of superior ability and experience as superintending surveyors. The duties of surveyor demand suitable education and talents, and some skill in the science of an engineer should also be regarded as a valuable qualification, and these qualifications must be fairly remunerated.

In the case of roads in town and suburban districts, these are generally under the control of a board having efficient officers, and if the roads are not properly kept it cannot be from want of proper machinery to effect this object. In many of these cases, however, the fact does not seem to be fully realized that efficiency in management means economy in cost, and that efficiency and cost are invariably in inverse ratio.

The growing practice of using narrow wheels for vehicles carrying heavy loads is very destructive to the roads, the width of surface covered by the narrow wheel not being sufficient to bear the heavy weight imposed on it. It has been proved by repeated and careful experiments that wheels with two-and-a-half-inch tires cause double the wear on a road than those do which have four-and-a-half-inch tires. On good roads there is no great advantage in a greater width than four and a half inches. Telford's rule was one inch of tire for every 500 weight on the wheel. By this a cart weighing with its load two tons would require four-inch tires. The following proportions have been advised by competent authority:

	WIDTH OF TIRE.	
	Without springs. Inches.	With springs. Inches.
$\frac{1}{2}$ to $\frac{3}{4}$ ton on each wheel.....	3	4
$\frac{3}{4}$ to 1 ton on each wheel.....	4	5
1 to $1\frac{1}{2}$ tons on each wheel.....	5	6

It has even been recommended by some that all carts weighing over 600 pounds should be restricted to wheels of not less width than four inches, and the vehicles drawn by more than three horses should have wheels of not less than six inches.

Wheels of a large diameter also do less harm to a road than small ones. Stones will be pushed and moved out of their places by the small fore wheels of a wagon, whereas the larger hind wheels will pass over without displacing them. Large and broad wheels not only do less harm to the roads, but cause less draught for the horses.

A perfectly good road should have a firm and unyielding foundation, good drainage, a hard and compact surface free from all ruts, hollows, or depressions. The surface neither too flat to allow water to stand, nor too convex to be inconvenient to the traffic; free from loose stones, the fresh material being put on whenever practicable in winter in such a manner as to inconvenience the traffic as little as possible; all mud scraped off the surface as soon as it arises and not left in heaps on the road, the longitudinal inclination not to be greater than such that a horse may trot down hill with a vehicle behind it without danger.

With the exception of the first and last, all these conditions may be obtained in our existing highways. The great bulk of the roads have been made without any sufficient foundation, and the coating of surface material is so thin that unless constant and vigilant attention is given, the wheels rapidly cut through the crust in wet or frosty weather. The rain thus gains a way into the under foundation, and large quantities of new material are required to be put on before the road can be restored. It is impossible now to provide these roads with good foundations, but it is practicable, notwithstanding, to convert them by proper management into very good roads.

In hilly districts it is not possible to reduce the inclination to such a gradient that a horse can safely trot down, but there exist numerous cases where, at a comparatively small expenditure, by taking off the crest of a hill and filling the hollow, dangerous portions of roads might be improved and convenience of the traffic greatly increased. A gradient having a rise of one foot in every 40 may be considered perfectly safe for a horse to trot down with a light vehicle. An inclination of one in 20 is too steep for convenient traction, and should, if possible, never be exceeded. The latter gradient is too steep, and is the cause of great inconvenience, especially in level districts, it being frequently impossible for a horse to take the load that he can well draw along the level road up such an inclination.

The power required to move vehicles along a road varies with its conditions. The harder and more level the surface the less tractive power is required. On a good paved road a force of 33 pounds is required to move a ton; on a well-constructed road maintained in good order, a force equal to 46 pounds, and on an ordinary country road, fairly well kept, 65 pounds is required; whereas, on a badly kept road, with loose surface, the force mounts up to double and even treble the last figure.

The result of experiments made on a macadam road by the author with a dynamometer attached to a wagon having 3-inch wheels, the total load being two tons, showed that on a road repaired with hard gravel picked off the land and broken by hand, a tractive force varying from 224 pounds up to 280 pounds was required to move the wagon. The same road, repaired with granite broken into cubes to pass through a two and a half inch ring, and on which more labor and attention had been bestowed, required exactly half the force, or 112 pounds.

Although it is seldom that new roads forming main lines of communication have now to be made, yet it is desirable briefly to state the method of construction adopted by the best roadmakers.

The plan adopted by Telford, the greatest road engineer probably since the time of the Romans, was first to level and drain the site of the proposed road, then to lay upon it a solid pavement of large stones, and on this a layer of stones carefully broken so as to pass through a two and a half inch gauge, and no stone weighing more than six ounces, and over all gravel or other fine material in sufficient quantity to hide the stones. Great attention was paid to the surface until it became thoroughly solidified, and then it would stand for several years with a very little repair, one of the roads constructed in this way requiring nothing to be done, beyond cleaning the dirt off, for six years after its construction.

Macadam, who earned his reputation more as a converter of bad roads into good ones than as a constructor of new roads, differed from Telford in his system. Instead of the first coat of rough pitching, he substituted a layer of hard stones broken into angular fragments. This was watched, and as ruts or inequalities formed they were raked and leveled and fresh material added until a hard and level surface was obtained. The material used for coating was the hardest he could obtain, preference being given to granite, greenstone, or basalt.

The great art in roadmaking is so to construct the surface that no wet can penetrate from the top, and so that the dirt cannot work up from the bottom. The foundation must be of such materials as to form a uniform and unyielding body.

Burnt clay is dry and porous, and, if well burnt and thickly covered, makes a good material, but unless these conditions are complied with, it is liable to rapid deterioration.

With the exception of some of the principal thoroughfares, few roads in this country have been formed with a proper foundation. Generally a quantity of such material as could most easily be procured in the neighborhood has been shot down, leveled, and then left to become consoli-

dated by the traffic. This has gradually been worn away by the action of the weather and the wear and tear of the traffic, till only a very slight coating of hard material remains. In wet and frosty weather the wheels rapidly cut through this thin skin, and allowing the water to get below the surface level and the mud to work up from below.

A visible track once made in a road, all the vehicles will follow in the same course, each cutting into the road and forming two deep ruts. The hardest-paved road will wear away if the traffic be all kept in one track. If drivers would only vary their track a few inches, one set of wheels would counteract the effect of the others, and the road remain uninjured. The advantage of this is proved by the fact that wherever there is a turn in the road, however deep the ruts may be on the straight part, they disappear at the turn, because at the turning the horses coming from different directions naturally vary their course round the corners, and one wheel obliterates the track of the other. The experience of all roadmen can testify to the fact that at these points less material and labor is required than at any other part of the road.

One material point in the maintenance of roads is the transverse form. Roads that are too flat hold the water and keep the surface wet. A road that is too round is not only inconvenient for the traffic, but wears badly. On a road that is too round there is a necessity for the traffic all to follow in the same track along the centre of the road, that being the only part where a vehicle can run upright. The continual tread of the horses' feet in one track in the centre soon forms a depression which holds the water, so that such a road is not so dry, and wears more unevenly than one of a flatter section in which the traffic is more evenly distributed over the whole width. If the surface be allowed to wear into tracks and ruts, the roundness will not clear it of water. The best form for the transverse section of a road is that of an ellipse, the surface having a very small inclination in the middle and a steeper fall at the sides toward the gutter.

In dealing with the ordinary repair of roads they must be divided into two classes, the first being those which have to endure the constant and heavy traffic of towns and their immediate neighborhood, and the second, those subject only to provincial and agricultural traffic.

The attrition caused by the wheels of the thousands of vehicles which pass over town roads, many of them carrying weights of several tons, produces an immense amount of wear and tear and necessitates frequent and expensive repairs. The great advantage and economy of paved surfaces in towns need not be dealt with here. Where there is much traffic it is impossible to prevent macadamized roads from wearing into dust in summer and mud in winter. The thickness of the material, thus converted from the hardest known rocks into mud and dust, has been proved to amount to as much in one season as four inches over the part of the surface exposed to the most wear and two inches over the whole surface. The difficulty of replacing this material and combining effectiveness of repair, with consideration for the users of the road, has been a matter of much discussion. The practice of laying a thick coating of stone over the road and leaving the traffic to grind it down to a level surface is barbarous to the horses, destructive to all light vehicles, and wasteful of the stone. To enable broken stone to bond together and form an even surface, some substance must be used that will allow each stone to keep undisturbed with its neighbor. Unless some filling-in material is supplied, from one-third to one-fifth of the whole mass must be ground down to fill up the interstices before the stone can be bedded. In the process the angles are rubbed off the stones until their surface becomes rounded, rendering them liable to be constantly loosened. On the other hand, all fine material added, especially if it be not of good character, is liable to work into dust in summer and mud in winter. If the filling material be of an adhesive character in certain states of the weather it clogs the wheels and tends to the destruction of the road. After a sharp frost, when the thaw begins, the effect may frequently be seen of the material of which the surface is composed combining with the moisture and horse-dung to work into a sticky paste, which adheres to the wheels of vehicles and draws out the stones from the roads. Some road surveyors have adopted the plan of mixing the filling-in material with tar before it is placed on the coating of stone. A road treated in this way if well rolled before being used has a surface almost impervious to wet, and, owing to its elasticity, of a very enduring character. Granite chips or the screenings of the broken slag are an excellent material for mixing with tar. The heap of material after mixing should be allowed to remain for several days before use, otherwise it will be too sticky.

Constant watering in dry weather and cleansing of the surface is absolutely necessary to maintain the surface of a macadam road in good condition. The method of repair observed by the best road surveyors is to have the roads repaired in winter. The material used is the hardest and toughest to be procured, broken to an even and regular size, the fragments not larger than will pass through a two and a half inch ring. The surface is covered with sharp material of the same character as the stone ground in a stone-breaker to a size known as chips. After the stone and filling in has been evenly spread, the surface is well watered and rolled with a steam roller weighing not more than ten tons. A greater weight than this is apt to damage the gas and water pipes. After continual rolling the surface becomes thoroughly consolidated and even and fit for the traffic.

(TO BE CONTINUED.)

MICRO-ORGANISMS IN THE ATMOSPHERE.

DR. PERCY F. FRANKLAND recently read before the Society of Arts a paper on "Some of the Conditions Affecting the Distribution of Micro-organisms in the Atmosphere," which is a very excellent statement of the present state of knowledge on this interesting subject. After a brief historical sketch in which the various methods of collecting and counting these micro-organisms are described and criticised, the author expresses his preference for a method by which a definite volume of air is drawn, by means of an air-pump, through a short piece of glass tubing containing two small porous plugs placed one in front of the other. Of these two plugs, the first is constructed of glass wool only, whilst the second is formed of glass wool and glass or sugar powder. The object of this arrangement is that the second plug, through which the aspirated air has to pass, shall offer more resistance than the first, and, consequently, in the second plug is found to be free from microbes, it may safely be assumed that the first plug has been sufficiently obstructive to the micro-organisms in the air passing through, and that they have all been retained by it. Each plug is then transferred, with special precautions, to a small flask containing a small quantity of sterile melted nutrient gelatine; with the latter the plug is now agitated so as to cause its rapid disintegration, and the liquid gelatine is then evenly spread over the interior of the flask and congealed by rotating it in a stream of cold water. The flask is then maintained at a suitable temperature, and in due time the colonies, each resulting from one of the micro-organisms deposited on the plug, make their appearance and can be counted or examined.

He prefers this method to the use of Hesse's, chiefly on the ground that it is more independent of the action of wind or aerial currents. Indoors, and in an undisturbed atmosphere, the results of this apparatus are practically the same as those obtained by Hesse's method; but in the wind, especially when the direction is variable, the results of Hesse's method are considerably the highest.

The average number of micro-organisms found in 10 litres of air varied, according to months, from 4 in January to 105 in August.

In comparing the relative abundance of micro-organisms in different localities, the number of organisms found in 10 litres of air was as follows:

Top of Primrose Hill, 9; bottom of Primrose Hill, 24; top of Norwich Cathedral spire (300 feet), 7; at the bottom, 18; Golden Gallery of St. Paul's Cathedral, 11; in the churchyard beneath, 70; in Kensington Gardens, 13; Hyde Park, 43; Exhibition Road, 554; in the Chemical Laboratory of Science Institution, 32; in the room of meeting of the Royal Society near the close of the session, 432.

In a third-class railway-carriage containing four persons, soon after starting, the number of organisms that were falling on one square foot per minute was 395. Soon after this the carriage was filled, containing 10 persons, after which it was found that the number falling per square foot per minute was 3,120.

Reference is made to the experiments of Dr. Fischer, a surgeon in the German navy, on the number of micro-organisms contained in air at sea. At a distance from land of 90 sea miles the average of the experiments gave one organism in 26 litres; when the distance from land was 120 miles, it was one in 93 litres. Out of 12 experiments made at a minimum distance of 120 sea miles, in eleven the air was absolutely germ-free, so that it would appear that the maximum distance to which, under ordinary circumstances, micro-organisms can be transported across the sea is about 120 sea miles.

In those places where fewest organisms are found—that is, at high altitudes and in the open country—the relative proportion of moulds to the bacteria is much higher than it is in the air of towns and enclosed spaces. It appears probable that the spores of moulds are more buoyant than bacteria and are therefore floated further and higher by air-currents.

COUNCIL OF CIVIL ENGINEERS.

THE Council of Engineering Societies on National Public Works had a meeting in Cleveland, June 20. There were present: E. L. Corthell, of Philadelphia; L. E. Cooley, of Chicago; Augustus Kurth, of New York, and John E. Eisenmann, of Cleveland. The meeting was called to receive the reports of sub-committees appointed at the annual meeting to compile information in regard to the organization and conduct of public works of various countries.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE sixth annual convention of this body was held at Manchester, N. H., on June 15, 16, and 17. On the first day a business meeting of the Executive Committee was held at the Hotel Windsor at 1:30 P. M., and the convention was called to order for the opening session at the Court-House at 3 o'clock. Vice-President Kent, of Woonsocket, in the chair. A letter from President Rogers was read explaining that his absence was caused by pressing business engagements which could not be put aside. The presiding officer then introduced Hon. John Hosley, Mayor of Manchester, who cordially welcomed the association to the city, and Mr. Kent responded in fitting terms.

The reading of the minutes was dispensed with, and the brief and business-like reports of the secretary and the treasurer were read, accepted, and ordered placed on file. The treasurer's report showed a cash balance of over \$500, with all bills paid.

On motion of Mr. Hall, of Quincy, a committee to nominate officers for the ensuing year was appointed by the chair, and consisted of Messrs. Hall, of Quincy; Noyes, of Newton, and Sherman, of Providence.

The Executive Committee presented the following list of applicants for membership, with the recommendation that the list be admitted. The convention adopted the suggestion of the committee with no dissenting voice.

FOR ACTIVE MEMBERS.

Rudolph Hering, Chicago; Frederick P. Stearns, Boston; William E. McClintock, Chelsea; George F. Swain, Boston; George A. Kimball, Boston; J. J. R. Croes, New York; Louis H. Knapp, Buffalo, N. Y.; Arthur W. F. Brown, Fitchburg, Mass.; R. A. Jones, Spokane Falls, Wash. T.; Wilson Henderson, Peterborough, Canada; William Molis, Muscatine, Iowa; E. A. W. Hammatt, Boston; R. S. Hicks, Stafford Springs, Conn.; Weaver Osborne, Fall River; Charles H. Baldwin, Boston; Charles E. Chandler, Norwich, Conn.; C. C. Hitchcock, Ware, Mass.; W. W. Robertson, Fall River; S. J. Winslow, Pittsfield, N. H.; Cyrus B. Martin, Norwich, N. Y.; C. H. Truesdell, Central Falls, Conn.; W. C. Boyce, Worcester; Melvin C. French, Kingston, Mass.; D. N. Tower, Cohasset, Mass.; Everett Burns, Westerly, R. I.; F. A. W. Davis, Indianapolis, Ind.; John C. Whitney, Newton; John L. Harrington, Cambridge; William Schwenk, Mount Carmel, Pa.; Solon F. Smith, Grafton, Mass.

FOR ASSOCIATE MEMBERS.

R. A. Robertson, Jr., agent of the Builders' Iron Foundry, Providence, R. I.; Pancoast & Rogers, New York City.

The routine business was followed by a paper on "Some Practical Details of Water-Works Management," by Edwin Darling, Superintendent of Water-Works at Pawtucket, R. I., which dwelt briefly and in a common-sense fashion upon the following points—viz.: The need that works should be well planned and well built, of a corps of efficient workmen, and of a compensation to employees sufficient to stimulate an interest in their work; the care and protection of main-pipes and gates, the care and location of hydrants to make them efficient for fire service, the examination of service to prevent waste, the maintenance of the purity of the supply, the duties of the superintendent and the relation which should exist between him and the water commissioners, the relations of the municipal authorities to the water department, and finally the good results which follow when the water works managers are properly sustained by the city or town officials. The evils of political interference in the conduct of any water department were strongly stated. The work now being done by the Massachusetts State Board of Health in the efforts to preserve the purity of inland waters was highly commended.

Mr. Darling's paper provoked an interesting discussion by Messrs. Clark, Richards, Walker, Hall, Kent, Tidd, Noyes, and Billings, which centered mainly upon hydrant details.

Nearly all of the replies to a question by Mr. Walker, of Manchester, as to whether the first cost of a special service should be paid for by the water department or by the consumer, were, in effect, that the consumer should bear the expense.

WEDNESDAY EVENING.

The report of Committee on Exchange of Sketches included a folio of twenty-six blue prints giving the general plan and primary statistics of as many different water-works, and arrangements were made by which the Secretary will furnish duplicate copies of this folio to members at five cents per sheet.

In the absence of the author, a paper upon the Water Tank at Fall River, Mass., by Patrick Kieran, Superintendent, was read by the junior editor. The paper was illustrated by a tracing of the structure and called out a discussion by Tidd, Parker, Hawes, Stacey, Kent, and Fuller.

A report from a Committee on Uniform Classification of Water Rates, written by A. H. Howland, Chairman, was read by the Secretary. The paper was a lengthy one.

Six different bases for classification were suggested, in what, to the writer, seemed to be the order of their value—viz.:

1. A minimum charge per family without any limitation.
2. Number of stories and height of building.
3. The assessed valuation of the property supplied.

4. The number of front feet in the lot.
5. The number of persons in the family.
6. The number of rooms occupied by the family.

THURSDAY MORNING.

The Nominating Committee reported the following list of officers, and the choice of the committee was unanimously ratified by the convention: President, Superintendent Edward Darling, Pawtucket, R. I.; Vice-Presidents, Superintendent Desmond Fitzgerald, Boston; Superintendent Willard Kent, Woonsocket, R. I.; Superintendent C. K. Walker, Manchester; Superintendent F. H. Parker, Burlington, Vt.; Superintendent George P. Westcott, Portland, Me.; Superintendent J. C. Broatch, Middletown, Conn.; Secretary, R. C. P. Coggeshall, New Bedford, Mass.; Treasurer, Water Registrar A. S. Glover, West Newton, Mass.; senior editor of *Water-Works Journal*, Professor George F. Swain, of Massachusetts Institute of Technology; junior editor, Superintendent William R. Billings, Taunton, Mass.; Executive Committee, Superintendent F. E. Hall, Quincy, Mass.; Superintendent Walter H. Richards, New London, Conn.; City Engineer, A. F. Noyes, West Newton, Mass.; Finance Committee, Water Registrar George E. Batchelder, Worcester, Mass.; Water Registrar Phineas Sprague, Malden, Mass.; Water Registrar James H. Hathaway, New Bedford, Mass.

It was voted to pay the secretary a salary of \$300 per year.

A congratulatory and fraternal telegram was received from the President of the American Water-Works Association, Mr. B. F. Jones, of Kansas City, Mo., to which the secretary was instructed to make a fitting reply.

A lengthy paper on the Water-Works of Ware, Mass., illustrated by photographs and blue prints, was read by F. L. Fuller, C. E., of Boston, and before the reading of the next paper the Committee on Exchange of Sketches distributed rolls of blue prints, each containing sketches upon the following subjects:

1. Mains and Connections at Pumping-Station.
2. Mains and Connections at Distributing Reservoir, by R. C. P. Coggeshall.
3. Vise for Making Cup-joint, A. B. Drake.
4. Blower and Lamp, H. W. Rogers.
5. General Plan of Works.
6. Reservoir Dams.
7. Diagram of Consumption, Edwin Darling.
8. General Plan of Marlboro Works, George H. Stacey.
9. Service-Box, Willard Kent.
10. Water-Tank, W. F. Codd.
11. Temporary Weir, William B. Sherman.
12. Automatic Air-Value, M. M. Tidd.
13. Watering-Cart Hydrants, W. H. Richards.
14. Dams and Embankments, W. H. Richards.
15. High-Service Motor, F. H. Parker.
16. Meter Attachment for Watering-Carts, National Meter Company.

The paper upon a High-Service Motor, by Mr. F. H. Parker, of Burlington, Vt., was listened to with great interest, and called attention to a machine quite unique in its design, purpose, and conditions.

The pressure of water to work the motor varies from $2\frac{1}{2}$ to 5 pounds per square inch, while the pressure against the pump with full tank is 86 pounds per square inch. The motor is in the line of main pipe; works with slight friction and with no shock; offers no resistance to supply of water in either direction; wastes no water, and is practically automatic.

Mr. James H. Hathaway, of New Bedford, read a short paper upon "Methods of Collecting Water-Rates," and the convention adjourned for dinner.

THURSDAY AFTERNOON.

The opening paper was upon Ashland Basin, No. 4, and the mixing and handling of concrete, by W. F. Learned, C. E., of Watertown, Mass.

The paper was finely illustrated by drawings, was listened to with great interest, and a lengthy discussion ensued until it was suggested by Mr. Billings that it be postponed until evening to allow the reading of the next paper on the programme, which was upon "Aeration and Filtration," by Charles B. Brush, C. E., of Hoboken, N. J., and which, in the absence of Mr. Brush, was read by Mr. Billings.

This paper was suggestive and valuable and called forth remarks from Mr. Fitzgerald, of Boston, and a very brilliant address from Professor A. R. Leeds, of Hoboken, N. J., and at the conclusion of his address a vote of thanks was tendered Professor Leeds for his timely remarks.

THURSDAY EVENING.

The time was devoted to a general discussion upon a variety of topics, and the following gentlemen were elected as members of the association:

Active Members.—L. Frederick Rice, C. E., Boston, Mass.; S. S. Coolidge, C. E., Engineer, Council Bluffs, Iowa; Professor Albert R. Leeds, Stevens Institute, Hoboken, N. J.; Solon M. Allis, Superintendent, Malden, Mass.; Winthrop M. Pitman, proprietor, North Conway, N. H.; A. E. Stearns, Water Registrar, Manchester, N. H.

Associate Members.—Prov. Cyl. Co., Providence, R. I.
Honorary Member.—Henry C. Meyer, Editor of THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

After discussing general topics the president said that the question of the place for the holding of the next meeting was before the house. On motion of Mr. Darling, of Pawtucket, R. I., Providence, R. I., was selected as the location of the next annual meeting. The question of the place for the holding of the fall meeting was then brought up, and on motion of Mr. Noyes, of Newton, Mass., it was voted that the matter be left with the Executive Committee. On motion of Mr. Darling, a vote of thanks was extended to his Honor Mayor John Hosley, for the cordial welcome he had given to the convention. And also that the same be extended to Superintendent Charles K. Walker for the consideration he had had for the comfort of the members. Mr. Hawes, of Fall River, Mass., then read a special vote of thanks to be extended to Mr. Walker, which, with much applause, was made unanimous. Mr. Walker made a short reply, and followed it up by stating the arrangements for to-day's festivities at the pond. Vote of thanks were then extended to President Henry W. Rogers, for the impartial manner with which he had conducted his office during the year, to the Vice-President of the present Convention and its Secretary for the manner with which they had conducted their respective offices. At this point Mr. Darling took the chair and began his term of office as President of the Association for the ensuing year. He said: "I thank the Convention for the honor placed upon me and will try to conduct the office to the best of my ability. I bespeak the hearty co-operation of all in the coming year, and hope that the association will be as prosperous in the future as it has been in the past." Then, on motion of Mr. Noyes, of Newton, a vote of thanks was extended to the board of editors of the *Journal*. After a few well-received remarks from Professor A. R. Leeds, of Hoboken, N. J., the convention adjourned at 9:30 o'clock.

The following members and guests were present: Robert C. P. Coggeshall, Supt., New Bedford, Mass.; Wm. R. Billings, Supt., Taunton, Mass.; Chas. K. Walker, Supt., Manchester, N. H.; Arthur E. Stearns, Water Registrar, Manchester, N. H.; Frank E. Hall, Supt., Quincy, Mass.; James H. Hathaway, Water Registrar, New Bedford, Mass.; Albert S. Glover, Water Registrar, Newton, Mass.; Jonas M. Clark, Supt., N. Hampton, Mass.; W. H. Richards, Supt., New London, Ct.; Chas. H. Baldwin, Natl. Meter Co., Boston, Mass.; Edwin Darling, Supt., Pawtucket, R. I.; R. M. Gow, Supt., Medford, Mass.; M. M. Tidd, C. E., Boston, Mass.; Willard Kent, Supt., Woonsocket, R. I.; W. C. Wilcox, ex-Water Registrar, Waltham, Mass.; A. G. Pease, Supt., Spencer, Mass.; Nathl. Dennett, Supt., Somerville, Mass.; M. C. French, Supt., Kingston, Mass.; J. H. Gamwell, Supt., Palmer, Mass.; S. S. Coolidge, Commissioner, Belknap Falls, Vt.; Geo. E. Batchelder, Water Registrar, Worcester, Mass.; John G. Brady, Commissioner, Worcester, Mass.; John C. Kelley, Natl. Meter Co., N. Y. City; H. B. Winship, Ludlow Valve Co., Norwich, Ct.; Richard Partee, Holyoke Hydrant Works, Holyoke, Mass.; C. W. S. Seymour, Superintendent, Hingham, Mass.; W. H. Thomas, Commissioner, Hingham, Mass.; George J. Ries, Superintendent, Weymouth, Mass.; A. B. Drake, City Surveyor, New Bedford, Mass.; William E. McClintock, City Engineer, Chelsea, Mass.; William M. Pitman, Commissioner, Lower Bartlett, N. H.; Phineas Sprague, Water Registrar, Malden, Mass.; William B. Sherman, Secretary Corliss Engine Company, Providence, R. I.; George H. Frost, *Engineering News*, New York City; Phineas Ball, C. E., Worcester, Mass.; James E. Beals, Registrar, Middleboro, Mass.; William F. Codd, Superintendent, Nantucket, Mass.; George A. Stacy, Superintendent, Marlboro, Mass.; David B. Kempton, Commissioner, New Bedford, Mass.; F. H. Parker, Superintendent, Burlington, Vt.; Jason Giles, Chapman Valve Manufacturing Company, Boston, Mass.; E. L. Buss, Chapman Valve Manufacturing Company, Boston, Mass.; Robert J. Thomas, Superintendent, Lowell, Mass.; Albert F. Noyes, City Engineer, Newton, Mass.; Geo. E. Winslow, Superintendent, Waltham, Mass.; C. W. Morse, Superintendent, Haverhill, Mass.; G. B. James, Jr., Commissioner, Haverhill, Mass.; Frank L. Fuller, C. E., Boston, Mass.; Dexter Brackett, Assistant City Engineer, Boston, Mass.; Desmond Fitzgerald, Superintendent Western Division, Boston; W. F. Learned, Engineer Water-Works, Boston; F. P. Stearns, Chief Engineer Massachusetts State Board of Health, Boston, Mass.; A. H. Brodick, Chadwick Lead-Works, Boston; H. W. Humphrey, Commissioner, Weymouth, Mass.; H. A. Nash, Commissioner, Weymouth, Mass.; W. H. Foster, Whittier Machine Company, Boston, Mass.; James P. Roberts, ex-Pumping Engineer, Lowell, Mass.; J. T. Murphy, Commissioner, Marlboro, Mass.; R. D. S. Mortimer, Commissioner, Marlboro, Mass.; B. Frank Polsey, Walworth Manufacturing Company, Boston, Mass.; W. T. Dotters, Superintendent, Winchester, Mass.; F. F. Forbes, Superintendent, Brookline, Mass.; Solon M. Allis, Superintendent, Malden, Mass.; G. A. Polsey, Sumner & Goodwin, Boston; George E. Evans, ex-City Engineer, Lowell, Mass.; Benj. S. Babcock, Superintendent, Nashua, N. H.; R. K. Yates, Superintendent, Northboro, Mass.; Edward H. Rice, Walworth Manufacturing Company, Boston; A. N. Hyde, Jr., Superintendent, Newton, Mass.; M. A. Ewell, Commissioner, Haverhill, Mass.; Weaver Osborne, Commissioner, Fall River, Mass.; William M. Harris, Commissioner, Fall River, Mass.; Patrick Kieran, Superintendent, Fall River, Mass.; W. W. Robertson, Registrar, Fall River, Mass.; L. L. Fuller, ex-Commissioner, Malden, Mass.; Professor Albert R. Leeds, Stevens Institute, Hoboken, N. J.; L. C. Lamphear, Davidson Steam-Pump Co., Boston, Mass.; George Woodman

DR. WOOLSEY JOHNSON.

DR. WOOLSEY JOHNSON, Health Commissioner of New York City, died in the New York Hospital, of which he had been an inmate for more than a month, on Tuesday, June 27, aged forty-five years. His death was caused by chronic diffuse nephritis and diabetes from which he had been suffering for several months. Dr. Johnson was graduated from Princeton College, and began the study of medicine with his uncle in Albany, N. Y. Coming to New York City to complete his studies, he was graduated from the College of Physicians and Surgeons in 1863. He then went to Europe and spent more than a year in study at Paris and at German Universities. On his return to this country he was married and began the practice of his profession, giving special attention to the eye and ear. He was surgeon of the New York Eye and Ear Infirmary and consulting physician at the New York Hospital, as well as medical examiner for some insurance companies. Dr. Johnson was a member of the County Medical Society, Academy of Medicine, the Laryngological Society, and the Physicians' Mutual Aid Association. He was also a member of the Manhattan, Century, and University Clubs. Dr. Johnson was appointed Health Commissioner by Mayor Grace in 1881, on the expiration of the term of Dr. E. G. Janeway. His wife died some two years ago. His health failed soon after her death and he went to Europe last summer, returning unimproved late in the fall. His term as Health Commissioner expired on May 1, but Mayor Hewitt had not yet appointed his successor.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ENGINEERING ADVICE WANTED.

WALLA WALLA, WASH. T., June 10, 1887.

SIR: Will you oblige me with an answer to the following: We have a little village situated at the mouth of a cañon through which flows a creek. Our idea of the best plan of supplying water to the village is to take the water from the creek, about a mile and a quarter above the village, and carry it by means of iron pipe placed along the bluff of one side the cañon to a hill just back of the village, in which a cistern or reservoir is to be dug to hold the water, which is from there to be distributed through the village by ditches and pipes. Our belief is that with a topography, as above given, such a method of supplying the village with water is the cheapest and the best. Are we, in your superior judgment in such matters, correct in that belief? In placing the pipe along the bluff to carry the water to the reservoir, there are some rocky places to the sides of which, we judge, the pipe will some way have to be attached or hung? What is a cheap and substantial way of doing this?

If you have a back number of your publication giving information on methods of supplying water and constructing the plant for a place situated as is our village, will you please send it to me? Thanking you in anticipation, I remain yours, etc., R. H. W.

[In reply to our correspondent we can only say that his general outline of a scheme seems feasible; but to avoid mistakes in detail, it always pays to employ some competent engineer to work up a plan, and it is poor economy not to employ one.

As to sustaining the pipes along a rocky face, wrought-iron brackets can be secured by leading into suitably prepared holes, or by "foxed" bolts.

Only general directions can be given, and each individual case must be treated according to its particular conditions.]

EXPLOSION OF WROUGHT-IRON OR STEEL TUBULAR BOILER.

KANSAS CITY, MO., June 15, 1887.

SIR: Do you know of a case where a wrought-iron or steel tubular boiler, used for low-pressure steam-heating exclusively, exploded? An answer in your valuable paper will very much oblige yours, A SUBSCRIBER.

[We know of no case in the history of low-pressure heating. Now and then a boiler is burned out and ruined by carelessness, but this applies to all classes of boilers. In the monthly report of the Hartford Boiler Insurance Company there once in a while appears a notice of a heating boiler blowing up, but a study of the case shows they are boilers in either workshops, depots or mills that presumably carry high-pressure steam, the water from which is wasted through traps or otherwise. They also usually occur at night-time when in the care of a watchman or under banked fires in the absence of any attendant.

The safety of a low-pressure gravity apparatus lies in the fact that the radiating surface is nearly always great enough to condense all the steam formed, and that with the increase of pressure the condensing surface (radiators) increase in condensing power, so that the safety-valve (though it may be small and poor) is usually able to cut off any steam the boiler may chance to make, above that which the heaters are able to condense, and keep the pressure below the dangerous point.]

NATIONAL MEETING OF THE MASTER CAR-BUILDERS' ASSOCIATION AT MINNEAPOLIS.

(By Our Special Correspondent.)

MINNEAPOLIS, MINN., June 18, 1887.

THE "Twin Cities"—St. Paul and Minneapolis, as they are called—are becoming more and more each year places where annual conventions and meetings of national bodies are held, and during this week just passed, the Master Car-Builders' Association of America has been holding the interesting sessions of its annual gathering. The sessions began Tuesday with an address of welcome by Mayor Ames, who spoke of the association as being one of the civilizers of the world. President B. K. Verbruyck, of Chicago, responded briefly, and then read his annual address, which was quite short. In it he called attention to the experiments which had been made during the year with automatic brakes and couplings, and said that the tests had been very thorough and that there ought to be at least one kind found that would be satisfactory to the trunk lines and to the Railroad Commissioners.

Secretary M. N. Forney, of New York, presented his annual report, which showed a membership in 1886 of 148 active, 81 representative, and 2 associate members, a total of 231, as against 223 in 1885. The number of cars represented in the association in 1886 was 580,056, as against 486,882 in 1885, and the view was put forth that there will be a marked increase in the number of cars this year. The receipts for the year were \$3,962.16; disbursements, \$3,275.53. The President announced the following committees:

Nominations—Robert Miller, Detroit; C. A. Smith, Jersey City; George Hockney, Elizabeth, N. J.; J. N. Barr, Milwaukee; George F. Wilson, Minneapolis.

Subjects for Investigation—Joseph Wood, Fort Wayne, Ind.; William McWood, Montreal; E. B. Wale, Columbus, O.

Correspondence and Resolutions—L. G. Matthews, Jeffersonville, Ind.; J. C. Barber, Brainerd, Minn.

To Select Place for Next Annual Meeting—W. F. Turrett, Cleveland, O.; H. Wilbur, Bethlehem, Pa.

Members of the Interstate and State Railroad Commissions were invited to participate in the deliberations of the association. The Secretary read correspondence relative to the Christie brake shoe, which has been adopted as the standard of the association. The general sentiment of the members was that no revision of the standard was advisable. The report of the committee on automatic brakes for freight-cars was read by G. W. Rhodes, of Aurora, Ill., describing in detail tests made with the Westinghouse, Carpenter, Ames, Hansenn, Curd, and other brakes. Among the points brought out were—that there is no mechanical difficulty in getting any amount of power required, the main trouble being getting a quick application of the power; that electrical appliances, properly devised and managed, may be made practical and valuable adjuncts, and that the best type of brake is one operated by air with the valves operated by electricity. The sub-committee of the executive committee presented a report on car-couplers, recommending the Janney type as the standard. The first business of the session of Wednesday was the election of officers, which resulted as follows:

President, William McWood, Grand Trunk Railway, Montreal, Can.; First Vice-President, J. W. Cloud, New York, Lake Erie, and Western road, Buffalo, N. Y.; Second, E. W. Grieves, Baltimore and Ohio, Baltimore, Md.; Third, John S. Lentz, Pennsylvania and New York Canal and Railway Company, Parkerton, Pa.; Treasurer, John Kirby, Lake Shore and Michigan Central, Cleveland, O.; Executive Committee, Joseph Wood, Pennsylvania Co., Fort Wayne, Ind.; R. D. Wade, Richmond and Danville Railroad, Richmond, Va.; T. A. Bissel, New York Central Sleeping-Car Co., Buffalo, N. Y.

An animated discussion arose out of the proposition to raise the settlement prices for new cars and trucks ten per cent. The proposition failed to receive the requisite two-thirds vote, as did another one to raise the settlement price of cars scheduled at \$450 to \$500. The list was finally referred to a committee for revision, and its report was adopted. The result will be that the prices of eight-wheeled cars will be raised from \$5 to \$25, according to classification. Box stock-cars, according to the new schedule, will cost \$475 where trucks with wooden transoms are used, and similar cars under thirty-two feet will cost \$440. No change was made in the prices for four-wheeled cars. The report was adopted. The report of the committee recommending the Janney type of coupler was then taken up. Mr. Rhodes favored this coupler, and referred at length to the experiments made at Burlington, Ia., on which the report of the committee was based. Mr. Miller thought the report went too far, and its adoption would force all the railways to adopt the Janney coupler. L. S. Coffin, one of the Railroad Commissioners of Iowa, who was never known to resist an invitation to speak on any topic in any assemblage, volunteered the statement that if God spared his life, and gave him the ability, he

would arouse the State of Iowa to such an extent that the legislature would see the necessity of action. He said that Iowa would not see her young men cut down at the rate of 200 a year when such slaughter could be averted. Mr. Stone proposed an amendment favoring the Miller-Cowel and link type and it was lost. The report of the committee was then adopted. The last day's session was divided between business and pleasure. The first business was the hearing of the report of the committee on accidents to trainmen. Taking as a basis the reports of the railroad commissioners of Massachusetts, New York, and Michigan, the committee estimated the number of railroad employees killed in the United States each year at 1,426, and the number injured at 6,548. Nearly one-half of the injuries are from coupling cars, but the percentage of fatal accidents from that cause is only 13; 27.4 per cent. are killed by falling from trains and engines, while only 18.5 per cent. of the injuries come from the latter cause. The committee regarded it as still an open question whether the use of automatic couplers had reduced the proportion and number of coupling accidents, and suggested improvement and uniformity of non-automatic draw-gear. An interesting discussion followed. Mr. Adams urged that the time had come for the association to take action on the matter looking to greater safety for the trainmen, and he would be sorry to see the association dodge the matter. He was of the opinion that the question was not one of new appliances—automatic or otherwise—but if the railroad companies would keep up in repair and use the appliances they now have, the loss of life and limb would be much less than at present. He thought the old pin-coupler, with an appliance for handling, would be safer than many of the automatic couplers. Mr. Cloud said that a good many of the accidents to trainmen were due to shocks and jerks in the handling of trains, and laid stress on the need of greater care by the engineers in starting up. The report was finally adopted, and the committee continued to next year. The committee on standard draw-gear for non-automatic couplers favored the pocket-drawbar as standing unrivaled for safety and durability, and recommended the plans adopted by W. Kirby, of the Michigan Southern road. Report adopted. Eleven kinds of car-roofs were reviewed by the committee on that topic, no special one being recommended. The president appointed John Kirby, of the Lake Shore and Michigan Southern; J. N. Barr, of the Chicago, Milwaukee and St. Paul, and Geo. F. Wilson, of the Minneapolis and St. Louis, a committee to represent the association in the car-wheel convention. The subject of car-heating and lighting was continued for another year in view of the many experiments now being made. The association chose Alexandria in the Thousand Isles as the place of next annual meeting. The Executive Committee re-elected M. N. Forney, of New York, as Secretary. The association adjourned *sine die*. In the afternoon of Thursday an excursion was made to Lake Minnetonka. Many of those present will attend the annual convention of the Master Mechanics' Association of the United States, which meets this week in St. Paul. The complete list of those who have been in attendance upon this convention is as follows:

Adams, F. D., Alston, Mass.; Adams, J. L., Huntington, Ind.; Ames, La Mott, Beech Creek, Jersey Shore, Pa.; Armbruster, Joseph, Knoxville, Tenn.; Avery, E. A., Grand Junction, Iowa; Baker David H., N. J.; Ballentine, D. W., Portsmouth, Va.; Barber, J. C., Brainerd, Minn.; Barnes, H. A., Stevens Point, Wis.; Bissell, Thomas A., Buffalo, N. Y.; Boatman, Vincennes, Ill.; Bryan, H. S.; La Crosse, Wis.; Buchanan, William, New York; Bushnell, R. W., Cedar Rapids, Iowa; Butler, C. I., Corning, N. Y.; Chapman, T. L., Richmond, Va.; Cloud, John W., Buffalo, N. Y.; Coghlan, John, East Boston, Mass.; Cooke, Allen, Danville, Ill.; Cushing, G. W., St. Paul, Minn.; Davis, James A.; Napanee, Deseronto, Ont.; Davenport, W. R., Pennsylvania; Demarest, G. W., Duncan, T. G., Cincinnati; Zaleski, Baltimore, Md.; Ellis, E. W., company, Chicago; Ennis, W. C. Wortendyke, N. J.; Ettenger, George W., Richmond, Va.; Finlay, L., Arkansas; Fletcher, John B., St. Albans, Vt.; Forney, M. N., New York; Forsythe, William, Aurora, Ill.; Foster, W. A., Corning, N. Y.; Gramling, G. H., Charleston, S. C.; Grieves, E. W., Baltimore, Md.; Griffith, Fred B., Buffalo, N. Y.; Hackney, Clem., Omaha, Neb.; Hackney, George, Topeka, Kan.; Haines, S. W.; Pittsburg, Pa.; Harris, George II., Columbus, Ohio; Harrison, W. H., Baltimore, Md.; Haslett, C. A., Chicago, Hatch, William B., St. Albans, Vt.; Hill, John, St. Paul, Minn.; Hitchcock, Robert, Springfield, Mass.; Hobart, C., Portland, Oreg.; Hodge, John, St. Louis, Mo.; Hunter, David W., Valley Falls, R. I.; Hurlbut, Francis B., Palatka, Fla.; Irvin, Samuel, Sedalia, Mo.; Jackson, Job H., Wilmington, Del.; Johns, C. T., Ohio; Keeler, Sanford, East Saginaw, Mich.; Kirby, John, Cleveland, Ohio; Lentz, Packerton, Pa.; Lyons, Henry D., Marquette, Mich.; McCarthy, H. C., Williamsport, Pa.; McIlwain, J. D., London, Ont.; McKenna, Robert, Scranton, Pa.; Mackenzie, John, N. Y., Cleveland, Ohio; Marden, J. W., Boston, Mass.; Martin, M. M., Decatur, Ill.; Mathews, L. G., Jeffersonville, Ind.; Sargent, George M.; Miller, Robert, Detroit, Mich.; Mills, C. W., Rochester, N. Y.; Nelson, E. D., Williamsport, Pa.; Packard, L., West Albany, N. Y.; Palmer, A. G., Jersey Shore, Pa.; Potts, Robert, St. Thomas, Canada; Pratt, Elias E., Boston, Mass.; Preston, H. L., St. Paul, Minn.; Rasmond, J. H., Chicago, Ill.; Rhodes, Godfrey, Richardson, David C., Lawrence, Mass.; Richardson, John, Ludlow, Ky.; Richardson, William J., Brooklyn, N. Y.; Roberts, H., Detroit, Mich.; Robertson, W. J., St. Albans, Vt.; Rowe, H. S., Portland, Ore.; Scott, W. A., Chicago, Ill.; Shel-

don, George O., New York City; Sheppard, Frank, Altoona, Pa.; Short, William A., Malone, N. Y.; Skinner, J. R., Oneota, N. Y.; C. A., Jersey City; Smith, Peter River, E. Rochester, New York; Snow, W. B., Chicago, Ill.; Stone, W. A., Louisville, Evansville, Ind.; South-erland, T., Detroit, Mich.; Surreff, W. F., Cleveland, Ohio; Verbruyck, B. K., Chicago, Ill.; Wade, R. D., Richmond, Va.; Wagner, J. L., Terre Haute, Ind.; Wall, E. B., Columbus, Ohio; Wallis, F. M., Philadelphia, Pa.; Webster, H. A., New York City; Welch, Benjamin, Sacramento, Cal.; Whitney, Henry A., Moncton, N. B.; Wilbur, Rollin H., Bethlehem, Pa.; Wilder, F. M., Binghamton, N. Y.; Wilson, George F., Minneapolis, Minn.; Wood, Joseph, Fort Wayne, Ind.; Choate, C. P., Detroit; Chase, W. K., Troy, Earle, E. T., Chicago; Hubbard, S. H., Chicago; Kent, John, Kittridge, A. M., Dayton, Ohio; Leighton, J. T., New York; Tippet, E. B., Louisville; Whitney, J. R., Chicago; Whittaker, A. C., Wheeling, W. Va.; Ward, C. F., St. Paul.

CONVENTION OF THE NATIONAL ASSO- CIATION OF MASTER PLUMBERS.

(From our own Correspondent.)

THE National Association of Master Plumbers of the United States met in Chicago, Ill., on June 21, at 10 o'clock in the ladies' ordinary of the Grand Pacific Hotel. James Allison, president of the association, accompanied by Andrew Young, Chairman of the Reception Committee, occupied the platform, and the latter spoke a few words of welcome to the convention in behalf of the city and the local association. "We will try and make it as pleasant as possible for you during your stay and we hope you will make it long."

President Allison having expressed thanks for the greeting, proceeded: "I can hardly express my pleasure and satisfaction at seeing so great a number present to-day, which shows conclusively that no interest in our work is slighted. I appreciate this, I assure you, on my own part and in behalf of the National Association. I am satisfied that your visit here will be a pleasant one, and I have no doubt a profitable one both for yourselves and the public. And now, as we are here for business, I will not waste words further, but at once proceed with the regular order of work. First in order will be the election or appointment of a Credential Committee. What is your pleasure, gentlemen?"

William McCoach, of the Common Council, Philadelphia: "I move the chair appoint the Credential Committee. So ordered, and President Allison named J. J. Wade, of Chicago; George Knipp, of Baltimore; M. Goss, of Kansas City (in whose absence Mr. McCarthy, of Kansas, was substituted); Mr. Wright, of Philadelphia. A short recess was taken pending the report.

The Credential Committee announced, through Secretary O'Neill, the following lists of delegates present and duly accredited, and as the roll was called they marched to the seats assigned them, the chairman of each delegation carrying the extemporized banner, in lieu of the silken emblems lost at Deer Park;

Alton, Ill., one representative—P. J. Kane.
Boston, Mass., nine representatives—John H. Stevens, President; Isaac Riley, John Crawford, William H. Mitchell, D. G. Finnerty, James F. Dacey, Thomas J. Tute, Frank A. Titus, E. G. Perkins.

Baltimore, Md., nine representatives—John McCart, President; William Dunnnett, D. B. Foster, George Knipp, William H. Rothrock, James Connelly, John Trainor, Joseph C. Mitchell, James Millar, Jr.

Brooklyn, N. Y., seven representatives—Mortimer J. Lyons, President; T. H. Radcliff, H. M. Noble, W. T. Hudson, J. J. Keenan, O. Merrin, D. Fragan.

Beatrice, Neb., one representative, Frank Barclay.
Bloomington, Ill., two representatives—Frank Morrison, George McIntosh.

Burlington, Iowa, one representative, Henry Erwinger.
Chicago, Ill., eighteen representatives—Robert Griffith, President; A. W. Murray, Martin Moylan, William Sims, T. C. Boyd, Hugh Watt, Michael Ryan, D. J. Rock, David Whiteford, William Bowden, Rupert Coleman, P. Sanders, J. R. Alcock, M. J. Corboy, J. J. Wade, Andrew Young, William Wilson, Thomas O'Malley.

Jacksonville, Ill., one representative—George E. Matthews.

Cincinnati, O., six representatives—Robert Carlisle, President; Richard Murphy, J. A. Gibson, Stephen J. Nolan, James Allison, Thomas McNeill.

Cleveland, O., three representatives—George S. Paine, President; Charles C. Dewstoe, Peter Desnoyers.

Columbus, O., two representatives—William Halley, President; E. A. Futerer.

Canton, O., one representative—L. B. Cross.
Decatur, Ill., one representative—Philip Mueller.

Denver, Col., three representatives—Thomas J. White, William McCarthy, William Crane.

Davenport, Iowa—James Cameron.

Detroit, Mich., four representatives—James Meathe, President; James Lane, John Cameron, J. H. Crumley, Richard Walsh.

Flint, Mich., one representative—Edwin Sterner.

Fort Wayne, Ind., two representatives—Thomas Mad-den, P. E. Cox.

Freeport, Ill., one representative—Charles Stetson.

Hampden County, Mass., one representative—C. P. Lyman.

Hudson County, N. J., three representatives—Joseph Zumbusch, James F. Blackshaw, I. W. Littell.

Nashville, Tenn., one representative—J. L. Park.

Bloomington, Ill., one representative—Robert Loudon.

Kansas City, Mo., four representatives—Henry Goss, President; J. L. Ryle, W. G. Ashdown, R. B. Farley.

Kansas State Association, four representatives—J. Giles Smith, Wichita; John E. Ford, Newton; J. J. Sheehan and William F. McCarthy, Topeka.

Louisville, Ky., four representatives—M. J. Duffy, President; W. H. Matlack, Thomas P. Watts, Simon Shulhafer.

Madison, Wis., one representative—Thomas Regan.
Milwaukee, Wis., five representatives—William E. Goodman, Hermann C. Apel, George S. Lyons, George A. Spence, Charles Polachek.

Minneapolis, Minn., three representatives—E. C. Cauvet, J. S. Cusick, A. W. Scott.

Lincoln, Neb., one representative—James H. O'Neill.

New York City, twenty-four representatives—John Byrnes, President; George D. Scott, Joseph A. Macdonald, William Young, Frank Reynolds, E. J. O'Connor, W. H. Quick, John Miller, J. N. Knight, Alexander L. Whitelaw, T. J. Tuomey, Philip Smith, T. J. Cummings, Timothy Sullivan, C. H. Kranichfelt, Jonas A. Rossman, George B. Brown, Cauldwell Frazer, H. G. Gabay, John J. Sullivan, Edward J. Brady, Thomas Cochrane, James Fay, William Austin.

New Haven, Conn., two representatives—Andrew J. Clerkin, Franklin A. Curtis.

Norfolk, Va., one representative—William E. Foster.

Omaha, Neb., one representative—John Rowe.

St. Louis, Mo., thirteen representatives—Jeremiah Sheehan, President; David Roden, William H. Graham, James A. Lynch, Thomas Cantwell, A. Boyce, William Norris, James McCartin, John Quinn, O. J. Gerhard, P. C. Ring, T. H. McMahon, J. F. Reardon.

St. Paul, Minn., three representatives—John H. Shea, George Dempsey, J. J. Dunnigan.

Pittsburg, Pa., five representatives—John M. Tate, President; Washington Jarvis, Robert J. Bradshaw, Louis Heilig, James J. Ricketts.

Philadelphia, Pa., seven representatives—William Harkness, Jr., Chairman; John J. Weaver, Enoch Remick, William M. Wright, H. A. W. Smith, J. Sellars Kite, William McCoach.

Providence, R. I., two representatives—George R. Phillips, Thomas Phillips.

Washington, D. C., three representatives—R. G. Campbell, President; E. J. Hannan, James Regan.

President Allison—I have the pleasure of announcing that there are 161 representatives present to-day, the largest number that has ever been gathered at one of our national meetings, which is certainly very gratifying to me, as I know it certainly must be to every member of our National Association. I now have the pleasure of declaring the convention duly assembled and ready for work. But before proceeding further I have one request to make, to beg your indulgence in the first place for any mistakes of mine, and that you will attend promptly, when adjourning, at the hours named for meeting again, and that you will preserve the very best order, so that we can facilitate our work and get through as quickly as possible, since I am told, after the work is over, the Chicago Association "have it in for you," as they say; I don't know what that means [laughter]. The Secretary has but one communication and that from San Francisco, and he tells me that in order to facilitate business, it being in an exceedingly fine hand, he has sent it to a type-writer.

Adjourned for dinner.

On reassembling, the convention was briefly addressed by George C. Prussing, of Chicago, who was introduced by the chair, as "the first instigator and first President of the National Builders' Association of the United States." Mr. Prussing said they were busy men met together for business, and while he appreciated such an introduction to a body so intelligent, they would yet excuse him from breaking in upon their programme at this time. He trusted to see them again.

Communications being in order, one was read from L. E. Ferman, President of the San Francisco Master Plumbers' Association, strongly favoring affiliation with the national body, and regretting the absence of Pacific Coast delegates at the convention. "We have done a great and good work here in California, and it has been the support of the National Association which has given us backbone and continues to strengthen us. The communication was placed on file.

H. G. Gabay, New York—I move that members, on rising to speak, announce their names. Carried.

Mr. Harkness, Philadelphia—If resolutions are in order I will present the following, passed by our association June 10: "That we request the National Association to insist that the plumbers of the country be classed as dealers by the manufacturers of terra-cotta pipe." Referred.

Reports of retiring officers being in order, Secretary Thomas McNeill, of Cincinnati, presented the record of the Executive Committee—how they had held four meetings, the first being at the New York association rooms, No. 54 Union Square, on October 4, when they met the State Vice-Presidents of the East, and took into consideration the trouble then existing in the metropolis and threatened throughout the country. "The result of that meeting was made known to you by a circular sent through State Vice-President T. J. Cummings, New York. At the second meeting, December 2, the president's nominees for committees were approved, the first half of the per capita tax called in, and the president authorized to call in the other half at his discretion. The labor troubles in our trade existing in New York, and of frequent occurrence throughout the country, received long

and careful consideration, when it was decided to communicate to each local association that their members should render the New York trade every assistance possible. The expenses of the Executive Committee, when on official business, were ordered to be paid by the National Association. The third meeting was with the New York association, President Byrnes in the chair, and again they met with the Observation Committee of the New York association, when the conclusion was expressed that nothing further could be done in that matter. The fourth and last meeting had just been held—the day before—in Chicago, all members present except Birkett, of Brooklyn, Mr. Wade, of Chicago, being chosen his proxy. The committee of metal-workers of the United States requested a conference with this committee, and this was granted, a meeting to take place the next day, Wednesday afternoon. Communications were received from Boston and Philadelphia, and action postponed until after this meeting with the metal-workers. T. C. Boyd stated that a committee of delegates from Chicago visited Milwaukee, and as a result of their visit the Milwaukee association is represented in this convention to-day [applause]. The thanks of the committee were presented to Mr. Boyd. The Executive Committee recommended the appointment of a committee by the National Association to buy goods at the lowest market rates for members of the association, also the similar appointment of a member thereof in every town to keep a record of all dealers and manufacturers, or master plumbers, violating any of the protection resolutions of this association, said committeemen to report to the convention. A modified order of business was adopted and bills audited amounting to about \$1,200. A resolution was passed approving the course of the New York master plumbers in maintaining that boys of America might learn the plumbing trade; also a resolution approving and adopting the code of principles set forth by that affiliated body, the National Builders' Association, at their Chicago convention in March."

The Chair—What is your pleasure regarding this report from the Executive Committee?

A. Young—I move the adoption, striking out all that part referring to purchasing goods at cost.

J. J. Weaver, Philadelphia—I move, as an amendment, that all the recommendations be referred to the Committee on Resolutions, when appointed, to report back to us tomorrow morning.

Secretary McNeill seconded the Weaver amendment and it was carried, simply the change in order of business being adopted immediately.

The Chair—As the Committee of Five on Resolutions I appoint Messrs. Byrnes, of New York; Hannan, of Washington; Rothrock, of Baltimore; Harkness, of Philadelphia, and Moylan, of Chicago.

On motion of Mr. White, Kansas City, all future resolutions were ordered to be offered in duplicate.

The secretary's own report was read by that official. He had visited Baltimore; also Cleveland, to help that association against the strike, and had their word for it that the visit was beneficial to them. During the year the membership of the National Association has increased to 1,359, a gain of 172 [applause]. "I have made a careful estimate of the master plumbers in this country, and place the number at 6,054, one-half of whom are in New York State, Massachusetts, Pennsylvania, and New Jersey. Only about one-fourth have any weight, and, as nearly all of these are now affiliated with us, we can carry out projects favoring the good of the whole craft. I thank all the members for personal kindness." Report accepted.

Mr. Weaver, of the stentorian voice, was asked by the chair to assist the secretary, suffering from a cold.

Financial Secretary Enoch Remick detailed the receipts from the \$2 per capita tax collected in two calls, and amounting to \$2,720, of which New York City paid \$450; Chicago, \$326; Brooklyn, \$254; St. Louis, \$180; Cincinnati, \$90, etc.

Treasurer M. J. Lyons, Brooklyn, in his third annual report, credited a balance of \$24.29 received at Deer Park, and total receipts of \$2,744.29, and now had a balance of \$869.10 [applause]. The account was ordered audited next day, the auditing committee at present having a sick chairman.

Inspector-of-Plumbing Lee, of Baltimore, being in attendance, was called up by the chair, introduced and seated with the other Baltimoreans, but no speech could be extracted from him.

Surrendering his seat to Vice-President John Trainor, of Baltimore, Mr. Allison submitted his report as chief executive.

On motion of Mr. Finnerty, Boston, seconded by Mr. Gabay, New York, the recommendations contained in President Allison's excellently received address were referred to the committee on resolutions, to report next day.

An invitation from Trustee Blatchford to visit the Chicago Manual Training School was, on motion of M. J. Corboy, Chicago, accepted, and the hour left with the Chicago entertaining committee.

Then came the reports of the State vice-presidents, meanwhile the committee on resolutions retiring, as also some others, to such an extent, indeed, that the segeant-at-arms, amid some amusement, complained he had much trouble to keep the convention out of the anteroom of lemonade frappe.

[We shall continue and complete our report of the convention in our next issue.—ED.]

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



Persons who make any use of the information they find in these columns we trust will not omit to mention **THE SANITARY ENGINEER AND CONSTRUCTION RECORD** as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 89-90-91-92.

WATER, SEWERAGE, ETC.

PENNSYLVANIA WATER COMPANIES.—Application is made to Governor Beaver for a charter for the Holmesburg Water Company, the object of which is to furnish a water-supply for Oxford and Lower Dublin townships. The subscribers to the act of incorporation are: Charles W. Stout, Furman D. Holmes, William Neill, Robert Johnson, Tustin Boileau, Charles Snyder, William B. Bunker, and Emerson Titus.

SOUTHBRIDGE, MASS.—A town meeting will be called to decide on sewerage.

GRAND HAVEN, MICH., will extend its water-works.

CALIFORNIA WATER COMPANY.—The Arroyo Taro Water Company has been formed to supply water to the upper Carpinteria Valley, Santa Clara County.

MARYSVILLE, CAL.—The new Marysville water company, the majority of whose \$1,000,000 of stock is owned by non-residents, proposes to take water from the O'Brien Ditch in a thirty-six inch pipe and deliver it in Marysville. It will supply power enough to run nearly all the machinery in Marysville.

PORT CHESTER, N. Y.—The trustees of Port Chester, at a special meeting June 17, authorized the committee on roads and bridges to enter into a contract with Freeman H. Merritt to build the proposed sewers for the village.

MERRILL, WIS.—Incorporated is the City Water-Works Company; capital, \$100,000.

WICHITA, KAN., Council is preparing for extensive drainage improvements.

WORCESTER, N. Y.—Our correspondent writes: "We have a company formed ('The Worcester Water Company'). Capital stock, \$35,000. We are now soliciting stock, which is as far as we have got. We have a fine natural reservoir located about one and one-half miles from the village with over 500 feet head."

NORTH MUSKOGON, MICH.—The Water Committee advertises for bids for water-supply, either by driven wells or some other system.

WHITE PLAINS, N. Y.—Governor Hill has signed a bill providing for a system of sewerage for this place.

RACINE, WIS.—3,000 additional feet of intake pipe for the water-works will be laid at once.

MINNEAPOLIS, MINN.—A pumping station will be built on Shingle Creek.

COLUMBUS, KAN., will construct a reservoir for the water-works. Address Long & Doubleday.

WESTFIELD, N. Y., proposes to obtain a supply of water from Chautauqua Creek. The expense is estimated at \$45,317.

ALBANY, N. Y.—The Water-Commission has returned to Andrews Bros. the form of contract by which the latter agree to furnish 100,000,000 gallons of water daily from driven wells. Meanwhile the report of the commission will be presented, with plans.

The Water Commission has sent its report to Common Council favoring a contract, at above price, with Andrews Bros.

COVINGTON, KY.—See our Proposal Columns for a reference to the construction of a water-works reservoir.

NORTH ATHENS, O., will have a supply of water from the Getty's Spring, which is estimated to yield 3,000,000 gallons daily.

MANKATO, MINN.—The Council Sewer Committee has just presented a report on sewerage, recommending that the plans of Messrs. Lewis & Curtiss, of St. Paul, be adopted. The system will be pipe sewers; estimated cost, \$17,000. No definite action was taken.

The City Engineer will lay new water-mains, costing \$5,000.

SACCARAPPA, ME.—Our correspondent writes: "There has been no action taken on water-works as yet, and I doubt of there being any until next March. At a special meeting held a short time since the matter was postponed."

ABINGTON, MASS.—The Big Sandy Water Service will be extended to West Abington as soon as possible.

MANITOU, COL.—The citizens propose to have water-works to cost \$30,000.

CARLINSVILLE, ILL., wants to have some party build water-works, stand-pipe system. Address the City Clerk, until July 15.

COLUMBUS, KAN.—Long & Doubleday will receive propositions for building water-works here.

ATHENS, GEO., wants water-works.

DARLINGTON, S. C.—Our correspondent writes: "We are contemplating water-works. We are now looking for a contractor for artesian wells, as in our locality that is the most practical way of obtaining a water-supply."

ANDOVER, MASS.—In March, 1886, the town voted to construct a system of water-supply for fire purposes, and about 7,500 feet of 8 and 10-inch iron pipe was laid, with 16 hydrants, at a cost of \$9,300. At the town meeting of March 7, 1887, \$5,000 was appropriated for the extension of the system for fire purposes, and \$1,000 for making surveys preliminary to the construction of a system for domestic, fire and other purposes—water to be taken either from Pump's or Haggett's ponds, in Andover, of about 100,000,000 and 600,000,000 gallons capacity respectively. A charter has been procured empowering the town to take water from said ponds.

WORCESTER, N. Y.—A company has been organized which is chartered by the State. The committee is now at work trying to raise a guarantee from the citizens for fire purposes, as the village is unincorporated.

WARSAW, N. Y.—The water-works have been bought by a New England company, and will be extended. The cost of the extension will be \$50,000.

KEARNEY, N. J.—The town has made an arrangement with the Jersey City Board of Public Works for a supply of water. Kearney to pay \$90 per 1,000,000 gallons. Mr. Davy is Chairman of the Water Committee of the Kearney Township Board.

ALTOONA, PA.—The Water Commissioners will employ a hydraulic engineer to gauge Homer Gap Stream, to make plans for a reservoir. The following resolution, passed by Council May 31, indicates just what the work will be:

"Resolved, by Common Council of the city of Altoona, Select Council concurring, that the Water Commissioners be, and they are hereby, directed to employ a competent hydraulic engineer to gauge the flow of the Homer Gap stream, and also procure plans and specifications of a reservoir at the proper elevation to give the highest point within the city at present a sufficient supply of water, said reservoir to hold not less than 50,000,000 gallons; also, to furnish an estimate of a line of pipe not less than sixteen inches from aforesaid reservoir to the city, and report the result of the same to councils at as early a date as possible. And it is further

"Resolved, That the Water Commissioners, in conjunction with the City Solicitor and Water

Committee of Councils, be, and they are hereby, directed to proceed to ascertain, at as early a date as possible, the cost of the right of way of Homer Gap stream; also, the right of way of line of pipe from said Homer Gap to the city, and report the same to councils as soon as possible."

SAN FRANCISCO, CAL., Council will pass on resolutions providing for the employment of two California engineers to prepare plans for sewerage.

FLUSHING, L. I.—The Board of Trustees on June 21 definitely ordered that proposals should be advertised for a 2,000,000-gallon pumping-engine. Address the Water Committee.

ALBANY, GEO., will have water-works and a street railroad.

PORTLAND, ME.—The Portland Water Company will build a reservoir on Manjoy Hill.

ATHENS, GEO., City Council is considering a sewerage system.

PORTSMOUTH, VA.—An agitation for a system of sewerage is begun.

WATERVILLE, N. Y., is agitating the water-works question, and has sent commissioners to Clinton and Richfield Springs to examine the works there.

ISHPENNING, MICH.—The common council has decided to employ an engineer to plan a system of sewerage. It is also proposed to build new water-works at Lake Sally.

WILLET'S POINT, L. I.—The United States Government has arranged to take a supply of water from the Flushing Water-Works. The Works will erect an auxiliary pumping engine. The Government has already obtained the iron pipe.

LAKE, ILL.—Chief Engineer Sprague has submitted to the Town Trustees specifications for two pumping engines, with a daily capacity of 8,000,000 gallons. The matter was referred to the committee of the whole.

WARSAW, ILL.—In reference to a report about water-works at this place, our correspondent writes: "No step has been taken to establish water-works here, but our citizens have subscribed money to bore an artesian well. We expect to have sufficient head for fire purposes."

WEST HOBOKEN.—See our proposals for reference to new sewer work.

GLEN PARK, COL.—A company with a capital of \$60,000 has organized for supplying Glen Park and Palmer Lake with water. A reservoir up the Monument Glen will store the water and large mains will conduct it to both towns, and at Glen Park there will be fire hydrants.

NORTH MUSKOGON, MICH.—The village officials have decided to sink about twenty drive-wells, and by so doing expect to increase their water-supply to about 500,000 gallons per day.

SOUTH FRAMINGHAM, MASS.—Governor Ames has signed the bill relating to the sewerage of this place, and Mr. S. C. Heald, of Boston, the Engineer, will prepare plans at once.

EAGLE RIVER, WIS.—The Eagle River Dam Company will construct a dam costing about \$5,000 two miles below Eagle River. Address Leander Choate, Oshkosh.

CLINTON, ILL.—The City Council on June 20 decided to establish water-works. Plans have been ordered prepared and sources of water will be investigated at once. The first cost will be about \$20,000.

FORT FAIRFIELD, ME.—Town meeting has voted to raise money to put in 30 hydrants for a water-supply.

FARMINGTON, ME.—A town meeting will be held to ratify a contract with the Water Company which has just been entered into by the village corporation.

TAUNTON, MASS.—The water-works authorities have received bids for the sinking of a number of wells to increase the water-supply.

ALLEGHENY, PA.—In reference to the reported removal of the water-works, the water committee has passed resolutions in opposition, and asking councils to abandon the project. The committee recommends the construction of a main sewer from the Eastern City line to a point below the water-works.

GREENVILLE, MICH., is considering the question of water-works.

MECHANICSTOWN, MD.—The Mechanicstown Water-Supply Company have decided to build their own works, which will be begun soon. Iron pipe will be needed.

THOMASVILLE, GA.—Proposals will be received until July 18, for building brick tower and tank for the Water-Works. For further information, address A. F. Prevatt, chairman water-works committee.

GAS, STEAM, BUILDINGS, ETC.

WEST TROY, N. Y.—The West Troy Gas-Light Company will receive the contract to light the village during the ensuing year.

NEWTON, KAN., will have a \$100,000 hotel.

MIDDLETOWN, N. Y.—Bids were received by the Village Trustees, June 14, for lighting the streets. The New York and New Jersey Globe Gas-Light Company offered to furnish seventy or more of their standard lamps with improved self-generating gas apparatus attached, giving a light equal in brilliancy to eighteen-candle power gas, for \$20.60 per lamp per year, the same to burn every night and all night. For a similar light until one o'clock A. M. every night, \$19.80 per lamp per year. If they were given a contract for two or three years they would perform the first-mentioned service for \$19.50 per lamp per year.

The Middletown Gas, Electric-Light and Fuel Company will furnish 35 to 50 electric lights, Voltaic arc system, to burn from early candle light until 1 A. M., every night, at \$182.50 per light per year; 10 additional lights at \$164.25 each. Or will furnish 15 to 30 lights, 20 to burn all night and every night, the remainder until 1 A. M., the former for \$237.25 per light per year, the latter at \$164.25; 10 additional lights if desired all night at \$219, or will furnish 25 to 50 lights, all night and every night, for \$200.75 per light per year; 10 additional lights, if desired, for \$182.50 each. The electric lights are to be what are known as "2,000 candle." The company light, extinguish, clean and supply with gas 70 to 100 lamps until 1 A. M. every night for \$23.80 per lamp per year, from 100 lamps up to 125 for \$22.80, above 125 for \$21.80. For all night and every night as above for \$32.80, \$31.20 and \$30.40. Will repair and maintain lamp-posts for \$1.50 per post per year. Lamp-posts to be fitted with burners consuming four cubic feet per hour. It is stipulated that for each light extinguished before the hour specified in the contract, the village shall deduct twice the amount the company would have been entitled to receive if such lamp had been lighted the whole night. The bids were referred.

WOBURN, MASS.—The Woburn Electric Light and Power Company, a new organization, was organized recently. N. J. Simonds, B. F. Whittemore, S. F. Trull, L. Thompson, and C. H. Buss are directors.

SOUTHBRIDGE, MASS., will have electric lights in the streets.

YANKTON, DAK.—The Electric Light Company intends to erect a plant, using the water from an artesian well for the power to drive the dynamos.

DENVER, COL.—Address J. J. Thomas & Co. who desire a natural gas-plant.

KEOKUK, IOWA.—Address George D. Rand in regard to a natural-gas company to be formed here.

KENOSHA, WIS., wants propositions for lighting the streets with gas or electricity.

ELECTRIC LIGHT COMPANY INCORPORATIONS.—The Southbridge, Mass., Electric Company. C. A. Dresser, Herman C. Wells, Andrew Hall and others.

The Jackson, O., Gas and Electric Light Company. Isaac Brown, H. L. Chapman, Moses Sternberger, T. J. Edwards, T. S. Matthews.

The Stockton, Kan., Electric Light and Power Company. James M. Wells, D. E. Miller, Atchison, Charles C. Woods, O. A. Higgins, and H. C. Reins.

The Paola, Kan., Electric Light and Power Company. J. W. Sponable, J. F. Donahue, H. M. McLachlin and others.

The Hays, Kansas City, Electric Light Company. Hill P. Wilson, M. J. R. Treat, Henry Oshaut, C. C. Brosius, and A. D. Gilleson.

The Dexter, Me., Electric Light and Power Company. Samuel S. Ireland and Levi Bridgeham.

SAN FRANCISCO, CAL.—The supervisors will contract with the California Electric Light Company for 8 mast lights.

CINCINNATI, O., has contracted with the Ohio Lighting Company for gasoline lamps at \$18.71 yearly per lamp, and 40 cents each for new posts.

NEWARK, N. J.—The Citizens' Freeman Electric Light Company has a proposition before the Board of Aldermen offering to furnish 2,000-candle-power electric lights for 20 cents per lamp per night.

CHICOPEE, MASS.—Thomas McDonnell, P. M. Judd, S. D. Stoddard, are of committee to investigate the electric-light question.

THE Manchester, N. H., Gas-Light Company's Works has been leased to the People's Gas-Light Company for 50 years, at \$32,500 per year.

FISKVILLE, TEX.—A company has been organized to bore for natural-gas.

SPRINGFIELD, MASS.—The Equitable Gas Company has applied for a franchise authorizing the laying of mains and supplying of gas.

JAMESTOWN, N. Y.—Address Orsino E. Jones, President of the Board of Trade, in regard to a natural-gas plant for this town.

FLORENCE, ALA.—A company with \$500,000 capital subscribed has been organized to build iron furnaces.

SEDALIA, MO.—The Empire Well Augur Company, of Ithaca, N. Y., has the contract for a gas-well here.

GRIFFIN, GEO.—It is proposed to build gas and water works here.

WABASH, IND.—It is reported that an Eastern syndicate has purchased the "Jumbo" gas-well at Fairmount, near here, and will lay pipe to Chicago.

STILLWATER, MINN.—The Stillwater Gas Company contemplate putting in a water-gas plant, at an expense of \$25,000.

CROOKSTON, MINN.—The contract for steam-heating and ventilating High School building has been awarded to the Porter Steam-Heating Company of Minneapolis.

RAILROADS, BRIDGES, CANALS.

CAIRO, MISS.—The iron-work for the bridge over the Ohio River will be made by the Union Bridge Company of Buffalo, N. Y.; price, about \$3,000,000.

RAILROAD.—The Marietta and North Georgia Railroad will be extended to Knoxville, Tenn. R. M. Pulsifer, of the Boston Herald, is interested.

RAILROAD.—A railroad will be built from Fort Wayne, Ind., to St. Louis parallel with the Wabash.

FLORIDA.—The incorporators of the Windsor, Lake Newnan and Prairie Creek Street Car, Canal and Navigation Company have for their object the operation of street cars in Windsor and steamboats on Newnan's Lake.

UNION SPRINGS, ALA.—It is proposed to build a street railway here.

RAILROAD.—The Tennessee Midland Railroad will build. Engineering parties are in the field. The principal office is in Memphis. A. S. Buford, of Richmond, Va., is President; R. H. Temple is Chief Engineer.

LITTLE ROCK, ARK.—An ordinance will be introduced at the next meeting of the City Council ordering the immediate construction of about fifteen miles of sidewalk.

The contract for grading Scott Street, between Seventeenth and Twenty-second, has been let to E. A. Weyd & Co. at nineteen cents per cubic yard.

THE Indiana and Lake Michigan Railroad, from South Bend to St. Joseph, is again projected.

NEW ORLEANS.—City Engineer Brosnan is preparing plans for paving a number of streets.

ALEXANDRIA, LA.—The Little Rock and Alexandria Railroad will be built. Colonel B. W. Johnson, of Little Rock, Ark., may be addressed.

LOS ANGELES, CAL.—Incorporated is the Los Angeles Cable Railway Company—capital, \$2,500,000—to build an extensive system of roads. Hon. J. F. Clark, S. P. Jewett, Charles Forman, and others are incorporators.

THE Buffalo, Rochester and Plattsburg Railroad will spend about \$1,000,000 in improvements.

RAILROAD.—The Oregon Pacific Railroad will be completed by New York capitalists. Rowland G. Hazard is one.

OAKLAND, CAL.—Burnham, Standeford & Co., of this city, have received orders for the construction of thirty-two cars for the new Powell Street Cable Road in San Francisco. The cost of the cars will be \$48,000.

DETROIT, MICH.—The contract for constructing the East Detroit and Grosse Pointe Electric Railway has been awarded to Gilbert

M. Moran, who will do the grading, track-laying, and ballasting and deliver the road ready for the wires and rolling stock.

NEWPORT.—Chartered is the Newport and New York Rapid Transit Company to cut a canal across Conanicut Island and establish a steamboat line. Daniel Watson, of Newport, is a leading projector.

BISMARCK.—The contract was let, June 7, to A. E. Beal, Thomas Fortune, and Nathaniel Skelton, of this city, for grading that section of the Aberdeen, Bismarck and North-western Railway extending from Napoleon, Logan County, to Bismarck and the steamboat landing, a distance of fifty-seven miles. The work must begin on or before June 10, and be completed by October 1 next. This company has also filed with the Secretary of the Territory articles of location of line to the coal fields in McLean County. Work between Aberdeen and Napoleon is now over half done, and Engineer Richards says that in thirty days more it will be nearly completed, ready for bridges. It is said the Manitoba will also grade a branch from Minot to Coal Harbor in McLean County this year, with the ultimate intention of continuing the line on to Bismarck and thence to a connection with the south-western extension of the Manitoba system at Ellendale.

BUTTE, MONT. T. is to have an electric and cable street-railroad service.

PALATKA, FLA.—The St. Johns and Halifax Railroad will build a large railroad bridge at Rolleston. Colonel S. B. Carter is engineer.

FLUSHING, L. I.—The franchise for a street railroad will be sold by the Village Trustees on July 11.

SPRINGFIELD, ILL.—The Secretary of State has licensed the Equitable Transportation Company, of Chicago, capital stock \$1,000,000, for constructing an elevated railway from Blue Island to Chicago.

PORTSMOUTH, VA.—It will have a street-railroad. Address Colonel William H. Stewart.

COSHOCOTON, O.—Address J. C. Fisher about the construction of the Coshocoton and Southern Railroad.

PITTSBURG, PA.—It is proposed to build a railroad bridge at Brunot's Island.

ST. PAUL, MINN.—The Milwaukee and St. Paul Railroad will be extended to Lake Minnetonka. R. B. Langdon is contractor.

LAWRENCE, MASS.—The Committee on rebuilding the burned Duck Bridge met June 18. Professor Vose recommended that a five-span structure be built, and that the contract be awarded to either the Rochester, the Niagara, or the South Broadway Bridge Company. The City Engineer was authorized to prepare the necessary plans and submit them next week.

CHATTANOOGA, TENN.—The Chattanooga Southern Railway has applied for a charter for a line within the State. W. Crutchfield, Robert Dougherty, John Y. Wood, and others are incorporators.

BIRMINGHAM, ALA.—The Birmingham, Atlanta, and Air-Line Railroad is being pushed. The president is Douglass Green, of New York City.

MOBILE, ALA.—The Mobile and Dauphin Island Railroad is begun. P. S. Page, of Scranton, Pa., has the contract for earth-work.

NEW YORK CITY.—Governor Hill has signed the bill authorizing the city to construct the Washington Heights Viaduct Bridge, to connect with elevated railroad. The Department of Public Works will direct the work.

BRIDGE.—The Massillon Iron Company, of Massillon, O., has taken the contract for building the new iron bridge over the Huron River at Rawsonville, four miles west of Belleville. The price is \$6,450.

BAKERSFIELD, CAL., will have a street railroad.

ARTHUR KILL BRIDGE.—Contractor Alexander McGaw, of Philadelphia, has been awarded the masonry work for the bridge of the Baltimore and Ohio Railroad Company across the Arthur Kill, Staten Island. The Phoenix Iron Company has secured the iron contract, and it is stated that all preparations have been made to start the construction of the bridge.

SANTA BARBARA, CAL.—John Cross, of Los Angeles, has the contract for building a street railway here.

WILKESBARRE, PA.—The Wilkesbarre and Parsons Railroad Company is just incorporated to build a street railway. H. H. Dorr, A. H. Phillips, P. H. Carpenter, W. W. Lee, A. W. Betterly, and A. C. Robertson are incorporators.

RAILROAD.—A survey of the Palisades is being made for the proposed Palisade Railroad Company. It is intended to have this road begin at the West Shore Railroad terminus at Weehawken, N. J., and follow the Palisades to Nyack. William Walter Phelps, it is said, has a large interest in the new company.

HELENA, MONT.—Incorporated is the Butte and Ruby Valley Railroad Co., to build from Butte to Madison County and Bozeman; incorporators, Henry Elling, W. W. Norris, A. J. Davis, and others.

RAILROAD syndicate has been formed and incorporated under the laws of New Jersey, under the title of the "Pennsylvania and New England Construction Company," to establish a through line under one management, from Slatington, Pa., to Hartford, Conn., and Springfield, Mass., by the purchase and consolidation of such existing roads as can be made use of, and the construction of such new lines as may be necessary.

PORT CHESTER, N. Y.—The Board of Trustees have decided to advertise for proposals to build a surface street railroad from Byram River through the village of Rye to Rye Beach.

PORT BYRON, N. Y.—A new canal feeder will be built by the State here.

THE Columbia, Newberry and Laurens Railroad Company, of South Carolina, is asking for bids on stone piers of a bridge over Broad River.

THE Macon, Geo., Construction Company has awarded the contracts for bridging, trestling and crossings on the line of the South Georgia and Florida Railroad to Baker & Putnam, of Thomasville, Geo.

RAILROAD.—The Framingham, Mass., Street Railroad Company proposes to build a line seven miles long from South Framingham to Saxonville.

RAILROAD.—Address Frank Jones, of Portsmouth, N. H., President of the Worcester, Nashua and Rochester Railroad, in regard to a proposed line of road from Canada to North Stratford.

THE Columbia, Newberry and Laurens Railroad is progressing.

WINNIPEG, MAN.—Proposals for the construction of the Red River Valley Railway have been considered by the local government, and that of Ryan & Haney accepted for the construction from Winnipeg to Pembina, sixty-five miles, for \$750,000.

RAILROAD.—Articles of incorporation of the Minnesota and Southwestern Railway have been filed in the office of the Secretary of State of Minnesota. The road will be constructed on a line from Northern Pacific Junction southeast to the boundary between Minnesota and Wisconsin. The principal place of business to be at Pacific Junction. The incorporators are James M. Paine, Edgar M. Wilson, Horace P. Breed, Frank W. Booth, Minneapolis; Asa Paine, Northern Pacific Junction; Mark Paine and A. M. Miller, Duluth; M. J. Clark, Grand Rapids, Mich.

SALT LAKE CITY.—Incorporated is the Utah Railway Company. James G. Taylor, of Nebraska; James Anderson, H. T. Duke and others, of Utah, incorporators.

RAILROAD.—A syndicate of railroad men has purchased the St. Louis Hotel at Lake Minnetonka, and will build a branch to the hotel from Hopkins Station on the Chicago, Milwaukee, and St. Paul, nine miles distant, the contract for the branch being let to R. B. Langdon, of Minneapolis.

ST. PAUL BELT RAILWAY COMPANY has been incorporated with a capital of \$1,500,000. Incorporators, Edmund Rice, Jr., W. G. Gaston, William Dawson, Jr., John H. Morrison, E. A. Jaggard. Object: to build a road to cross all other roads in St. Paul, with a common centre for distributing freight.

BIG RAPIDS, MICH., will issue bonds to the amount of \$15,000, for an iron bridge over the Muskegon River.

ANNAPOLIS, MD.—The Baltimore and Drum Point Railroad is preparing to build. The President is Augustus Albert.

MONTGOMERY, N. Y., will issue bonds to the amount of \$13,000, for a new iron bridge over the Walkkill River.

DULUTH, MINN.—Address President Hoyt in regard to the construction of the Duluth, Red Wing, and Southern Railroad.

DENVER, COL.—Utah and Pacific Railroad will be extended to Laramie City. Henry Wolcott is chairman of the Board of Directors.

HYON PARK, ILL.—The village clerk advertises for bids for an iron bridge over the Calumet River.

BIDS OPENED.

TORONTO, ONT.—The contract for dredging in the harbor has been let to Messrs. I. & I. Conlan, of Thorold, Ont. The Harbor Commissioners decline to give the price of this or other bids.

KROKUK.—The contract for grading the public highway has been given to C. A. McNaman at 23 cents per yard.

LEAVENWORTH, KAN.—The contract has been let for the building of a hospital building at the Soldier's Home at Leavenworth to James A. McConigle, of that city. The cost of the building will be \$93,000.

CROOKSTON, MINN.—The contract for steam heating and ventilating apparatus for the high school building has been awarded to the Porter Steam-Heating Company, of Minneapolis, at \$2,843.

HAMILTON, O.—The following bids for water-supply from tube-filter wells (3,000,000 gallons in 24 hours) were received by the Board of Water-Works Trustees, June 16: The National Water-Supply Company, Cincinnati, O., the work complete according to plans and specification, for the sum of \$9,000. The above bid was opened and laid over for further action of the board.

FLORENCE, KAN.—Bids for constructing water-works were opened June 16 by the Florence Water-Supply Company, J. W. Nier, Engineer, and awards of contracts were made to the following parties: Deane Steam-Pump Company, Holyoke, Mass., pumping machinery; H. C. Darby, Kansas City, Mo., boilers and stand-pipe; Holy Manufacturing Company, Lockport, N.Y., gates and hydrants; Shickle, Harrison & Howard, St. Louis, cast-iron pipe and special castings. The prices are withheld.

MINNEAPOLIS.—Contracts on the work-house annex have been awarded as follows: For the brick work, F. A. Johnson, at \$16 per 1,000; for the iron work, Herzog Manufacturing Company, \$4,080; for the stonework, O. B. Brown, \$1 50 per footings.

TRENTON, N. J.—The Safe Deposit and Trust Company has awarded a contract to Titus & Conrad for a building at \$10,000, and to Diamond & Co., of Boston, for vaults at \$13,600.

ALBANY, N. Y.—Contracts for constructing School No. 3 have been awarded by the School Board as follows:

Mason-work, Cassidy & Gallagher, \$9,845; carpentry, Alexander Simpson, \$5,749; iron-work, McKinney & Son, \$1,844; roofing, James Ackroyd, \$1,034.20; painting, Hudson & Wallace, \$635; plumbing, Fitzgerald Bros., \$706; heating and ventilation, Smead & Northcote, \$2,005.

NEW YORK CITY.—The Armory Board opened bids June 10 for the construction of the armory of the 22d Regiment, after plans by Mr. George B. Post. They were as follows:

Plumbing-work, John J. Sullivan, \$13,970; John Spence, \$13,797; George Cully, \$13,693; John Kenahan, \$13,000. For carpenter-work there were three bidders—Mahony Bros., \$94,360; Christie & Foster, \$105,700; Maguire & Sloan, \$98,072. For heating and ventilation two bidders—Baker, Smith & Co., \$12,873; Jacob Jamer, \$12,985. There was but one bid each for masonry-work and iron-work; for the former Moran & Armstrong bid \$186,443, and for the latter the Wallis Iron-Works bid \$114,300. Taking the lowest of the estimates the new armory would cost \$419,688. The cost under the bids was excessive, and new advertisements will be issued.

MIDDLETOWN, N. Y.—The Board of Supervisors have received bids as follows, for the extension of the Clerk's office and Surrogate's Court room: Ah-wa-ga Iron Works, Caldwell & Gray, Oswego, \$9,993.23; Caldwell, Wilcox & Company, Newburg, N. Y., \$10,000; Atlantic Iron Works, New York City, \$10,147. The contract was awarded to the Ah-wa-ga Iron Works.

ALLENTOWN, PA.—The Board of Water Commissioners opened proposals June 21, to furnish two 3,000-gallon pumps for the proposed new water-works at the Fountain House property. The bidders were the Holly Manufacturing Company, of Lockport, N. Y.; Knowles Manufacturing Company, of Holyoke, Mass.; Davidson Pump Company, of Brooklyn; Deane Pump Company, of Holyoke, Mass.; Robert Wetherill & Co., of Chester, Penn.; Southwick Foundry and Machine Company, of Philadelphia; Henry R. Worthington, of New York. The prices of bids are withheld.

NEW YORK CITY.—Bids were opened at the Department of Docks on Tuesday, June 21, for building a new wooden pier at the foot of West Thirty-first Street, North River, to be known as Pier New, 61, North River.

Bidders: Joseph Walsh, \$48,000; E. Sanford Ross, \$50,750; James D. Leary, \$52,240; John Gillis, \$56,388.

BROOKLYN.—The Board of Supervisors of Kings County has awarded the contract for the County buildings at St. Johnland to P. J. Carlin at \$890,000, and for electric-lighting, at the same place, to the Edison Electric-Light Company at \$37,000.

GOVERNMENT WORK.

PEORIA, ILL.—Synopsis of bids for materials, tools, and labor for plumbing and gas-fitting for Post-Office and Court House, opened June 17, by the Supervising Architect of the Treasury Department: Forsyth & Clark, Peoria, Ill., cast-iron pipe and fittings, \$3,935.85; wrought-iron pipe and fittings, \$3,869.45; J. F. Dalton, Boston, Mass., \$4,650 and \$4,800. John M. Simpson, Peoria, Ill., cast-iron pipe, \$5,607.72.

Kinsley & Mahler & Co., cast-iron pipe, \$4,550. John O'Neal & Sons, Peoria, Ill., cast-iron pipe, \$3,554; wrought-iron pipe, \$3,695.

Crook, Horner & Co., Baltimore Md., cast-iron pipe, \$3,700.

SYNOPSIS of bids for columns for 2d, 3d, and 4th stories, and beams for 3d, 4th, and 5th floors of the Court-House and Post-Office, at Louisville, Ky., opened June 22 by the Supervising Architect:

The Marshall Foundry and Construction Co., Pittsburg, Pa., \$32,184; Sneed & Co. Iron-works, Louisville, Ky., \$35,500; M. A. Sweeney & Bro., Jeffersonville, Ind., \$41,938.54; Pennsylvania Construction Co., Pittsburg, Pa., \$36,875; Haugh, Ketcham & Co. Iron-Works, Indianapolis, Ind., \$37,956.53.

SYNOPSIS of bids for iron-work of 3d and 4th floors of the Court-House, etc., Des Moines, Iowa, opened June 17 by the Supervising Architect of the Treasury Department:

Marshall Foundry and Construction Co., Pittsburg, Pa., \$6,447; Benton Foundry Co., Chicago, \$6,000; Dearborn Foundry Co., Chicago, \$6,280; Clark, Raffin & Co., Chicago, \$6,569; Haugh, Ketcham & Co., Indianapolis, Ind., \$6,687.65.

SYNOPSIS of bids for rebuilding the Revenue Steamer "McLane," now lying at Baltimore, Md., opened by Secretary of the Treasury:

H. A. Ramsay and Son, of Baltimore, Md., \$32,936. Charles Reeder and Son, Baltimore, Md., \$32,445. The Pusey and Jones Company, Wilmington, Del., \$54,000.

Columbian Iron Works, Baltimore, Md., \$60,000. J. Bigler, Newburg, N. Y., \$35,083.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1886, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 5. } PUBLISHED EVERY SATURDAY.

NEW YORK, JULY 2, 1887.

LONDON, JULY 16, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

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THE POUGHKEEPSIE BRIDGE BILL.

GOVERNOR HILL, of New York, has signed the act passed by the State Legislature regarding the Poughkeepsie bridge.

After a patient hearing of the opponents of this bill, the Governor arrived at the only just conclusion possible—viz., that it would be an abuse of power to veto it.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD has favored the building of the bridge, and is glad to see that, apparently, no impediment now remains to its completion.

Within reasonable limits, the widest possible freedom should be given to the development of commerce in every direction. There is undoubtedly a natural jealousy on the part of those navigating the Hudson River against the placing of the slightest impediment in its channel. When piers or other structures are liable to cause a dangerous contraction of the navigable channel in the river, it would be an abuse of power to authorize their construction. The Legislature must, however, look at all sides of such a question, and when it is considered that for 150 miles the Hudson River has always been a barrier to land communication, it is manifest that the building of a bridge should not be prohibited or interfered with except upon the most positive proof of danger to the interests of navigation.

To all who have studied the problem, the claims that piers at 500 feet distance from each other in a stream like this can be so dangerous as to cause the diversion of the freight to other routes is preposterous. That there is a great increase in the liability to accident is also untrue.

We are strong advocates of the untrammelled use of our waterways, and of the development of many now unused. At the same time we uphold all proper development of our railroad system. Both are necessary, and legislative aid should only be invoked to prevent abuse and not to hamper either in its rightful progress.

YELLOW FEVER AT KEY WEST.

THE outbreak of yellow fever at Key West has produced the usual conflicting reports. On the one hand the Government medical officials say that it has established a foot-hold, and that the place is dangerous to all who have not had the fever, and this is probably the truth. On the other hand, we have telegrams and reported interviews with inhabitants of Key West to the effect that the fever has been stamped out; that there has probably not been any yellow fever; that there is an unfounded scare gotten up to injure business; that the place never was healthier, etc. But Key West is a good place to keep away from just now, all the same, and it is a source of grave danger to the South Atlantic and Gulf Coast, the ports of which can hardly take too stringent precautions against the spread of infection from it.

REPORT ON DISPOSAL OF THE SEWAGE OF THE CITY OF WORCESTER.

THE report by Mr. Charles A. Allen, City Engineer of Worcester, contains a concise description of the methods used for the treatment and purification of sewage at the Croyden, Doncaster, and Wigan sewage-farms, the Paris, Berlin, and Dantzic irrigation, and at the Burnley, Bradford, Lee, and other precipitation-works, and data as to the quantity and com-

Worcester. His report of a visit to the Pullman sewage-farm coincides with what we learned on the occasion of a visit in May, 1886, which was editorially referred to in our issue of June 17, 1886. He says:

"The farm is run for the purpose of making money, the purification of the sewage being a secondary consideration."

"During the summer months, when vegetation has received all the sewage it will bear, it is simply turned into Lake Calumet in its crude state."

Mr. Allen recommends the adoption of a chemical precipitation method for dealing with the Worcester sewage, and gives the following reasons:

"First—That the effluent obtained will, without doubt, conform to the requirements of the law.

"Second—That the cost of establishing a plant will be less than by either irrigation or downward intermittent filtration.

"Third—That chemical precipitation will not be affected by climatic conditions.

"Fourth—There will be no loss of water, and, consequently, no damages to pay.

"Fifth—If this method be adopted the city will be in a position to take advantage, without material change in plant, of improvements that will undoubtedly be made in the methods of sewage disposal.

"Sixth—That precipitation will be a valuable auxiliary to irrigation or intermittent filtration, if it should ever be thought desirable to add either of these methods of disposal to the system."

The analyses made indicate that the sewage of Worcester is acid, and that it contains a large amount of soluble sulphate and salts of iron, these characteristics being due to the large amount of factory wastes. The chemical process proposed is the addition of milk of lime, which, it is thought, will, in connection with the iron salts already in the sewage, give a satisfactory effluent.

Mr. Allen lays considerable stress on loss of water to the stream as an objection to any plan of disposing of the sewage by irrigation, on the ground that claims for damages will be made against the city by owners of mills lower down the stream if the stream is diminished.

The estimated cost for the construction of intercepting and outfall sewers, and for land, tanks, and machinery, is \$322,758.75. The daily amount of sewage to be treated is estimated at 3,000,000 gallons, or an average of 60 gallons per head per day for 50,000 persons, and the annual cost of the chemical treatment is put at \$22,500.

Whether one agrees with Mr. Allen's conclusions or not, his report is an interesting one, and brings out clearly the necessity of considering local conditions in advising as to a system of sewage disposal.

THE CONVENTION SEASON.

THIS is the time of year when the numerous associations of technical and scientific men meet in some pleasant resort to exchange experiences, make acquaintances, and have a good time generally.

The social part of these meetings is generally admirably managed, and the excursions, reunions, banquets, and receptions furnish to the members that "change of labor" which is looked upon as "rest," and is really of incalculable benefit to men who, during the rest of the year, are generally a hard-working and hard-worked class.

The excuse which our practical tendencies make it necessary to offer for any relaxation from the everlasting daily grind of business is in this case put forth as the advantage and benefit to be derived from an interchange of views and experience on subjects of common interest in the business which occupies the attention of the members of each association. If such interchange of experiences did actually take place, the benefit which is claimed for it would doubtless follow; but the complaint which most of those make who cannot attend the meetings, but rely upon the published reports, is that the objects of the meeting do not appear to be carried out in spirit or in fact. And there is a great deal of truth and force in this complaint. Papers are read, to be sure, and speeches are made, but the mass of verbiage contains very few nuggets of fact which are worth digging for in the voluminous reports. The cause of this is to be found in the diffidence of members who are more accustomed to think and act than to write or talk in public. Such men are very

variety of problems concerning the disposal of sewage, or other problems coming before the city and water-works engineer; or, in general, in those branches of the profession which do not appear to have among their practitioners as many men who are ready to tell what they know as some that are in other branches. Above all, managers of such meetings should remember that figures and statistics as such are meaningless and unprofitable, and the reading of them in public an intolerable bore.

OUR BRITISH CORRESPONDENCE.

Sea Water for Street Sprinkling—Competitive Plans for Municipal Works in Oldham—Registration of Plumbers—Extreme Heat.

LONDON, June 15, 1887.

THE evidence given before the Local Government Board inquiry in the matter of sea-water for street-sprinkling and

In the first place, there is the old story of miserable premiums, to which architects are beginning to get used by this time. They, however, ask the competitors to state what commission they would charge if engaged to supervise the work. Competition is truly the order of the day with them.

The registration of plumbers in Great Britain does not progress as favorably as it should do. At the fourth meeting of the General Council, it was stated that 495 journey-men plumbers was the total number registered up to the present time, exclusive of master plumbers, and that the total cost had been £2,017 (\$9,681.60). There is, of course, an offset in the sum of £850 (\$4,080) received as fees. Mr. George Shaw stated that in the course of examinations, which were purposely made as easy as possible, it was discovered that applicants were continually unable to pass the most simple test. In one case 50 per cent. only had passed.

The sudden spell of heat, the maximum reached being 139.9° Fah., has had the effect of expanding a portion of the railway metals in Lancashire on the London and



A COTTAGE AT ROCKAWAY, L. I.

apt to labor under the delusion that a paper ought to be exhaustive in its treatment of its subject, and elegantly written, and that they have not the time nor the literary ability to produce anything worthy of presentation to their associates.

This is a very mistaken idea, and the sooner it is gotten rid of the better will it be for the societies and their members. It very often occurs that a very short statement of actual practice in any work of construction, clad in the simplest language, will elicit from its hearers a far greater fund of interesting and important information, and of reasons for certain methods of practice, than any elaborate dissertation could possibly do.

We commend this thought to the Convention of the American Society of Civil Engineers now in session at the Hotel Kaaterskill. These conventions are usually productive of much interesting discussion, and we trust that some member of this one will open up a lively interchange of views on some subject which is new or has not yet been worn out. For example, the great

flushing purposes will be of interest to borough engineers. The inquiry was in connection with the scheme of the Commissioners of Bournemouth for laying down pipes for filling water-carts, etc. It was stated that the cost of the water would only be about 5d. (10 cents) per thousand gallons for a period of 30 years, after which time the loan would have been discharged, and the cost would then be only 3d. (6 cents). Mr. Percy Boulnois, the Borough Engineer of Portsmouth, stated that salt water was particularly adapted for purposes of street-sprinkling, especially for gravel, as the salt skinned on the road, and that under ordinary conditions the effects of one sprinkling of salt-water a day were equal to two sprinklings with fresh water. The Borough Engineer of Great Yarmouth, Mr. J. W. Cockerell, confirmed the statement as to the skinning, and upheld the utility of salt water for flushing the sewers. The scheme for Bournemouth is under the charge of the Surveyor, Mr. G. R. Andrews, and the plant will be two 9-horse-power gas-engines, about 12,000 yards of 6-inch and 11,500 yards of 4-inch main, with 57 standards and 57 hydrants.

The Borough of Oldham, in asking for plans in a competition for certain municipal works, is striking out a new line, which will certainly not be appreciated by architects.

North-western system, between Huyton and Prescott, to such an extent that the rails became contorted and a partial block of the traffic ensued. This is notwithstanding the fact that an allowance is made in laying down the lines for a small longitudinal expansion.

SAFETY-VALVE.

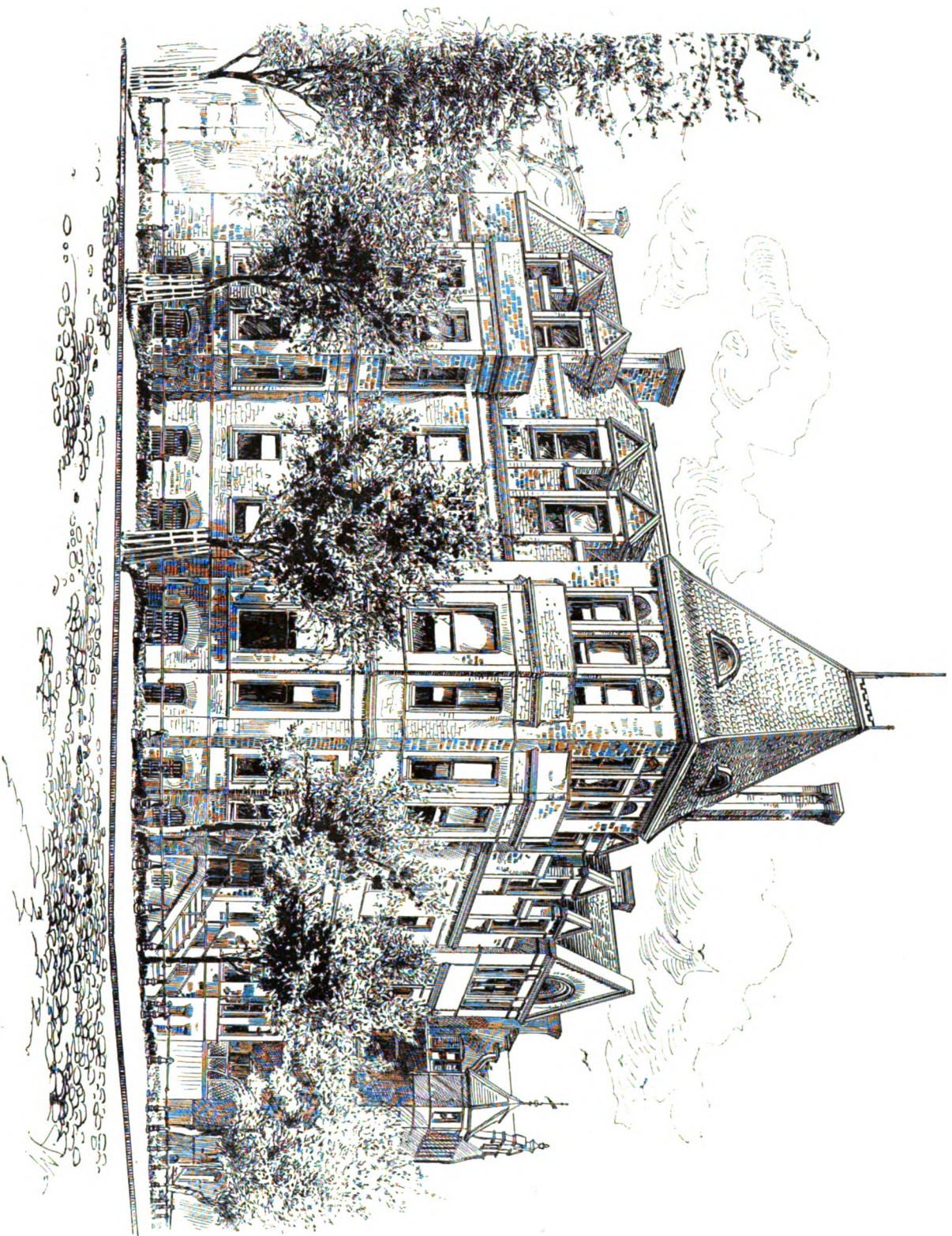
OUR SPECIAL ILLUSTRATION.

THE subject of our special illustration this week is the house for the Metropolitan Club, situated on the corner of H and Seventeenth Streets, N. W., Washington, D. C. The building is constructed of brick and stone, with a hardwood finish. The cost of the building was \$35,000. The architects were Messrs. W. B. Gray and H. L. Page.

OUR VIGNETTE ILLUSTRATION.

A COTTAGE AT ROCKAWAY, L. I.

THE subject of our vignette illustration is a cottage at Rockaway, L. I. The architect's name is not known to us.



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THE METROPOLITAN CLUB, WASHINGTON, D. C.

GRAY & PAGE, ARCHITECTS.



BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XIX.

(Continued from page 12.)

THE use of narrow-gauge portable track as an adjunct to a contractor's plant is rapidly extending, especially as contractors learn the great saving in time and money accompanying its use, and the increased facilities it affords for doing work.

In all parts of Europe, on small as well as large jobs, will be found what is called the "Decauville," from the name of the originator and maker. This is a narrow-gauge, portable track fitted with different kinds of wagons, according to the material to be handled. The track is all steel, made up in sections 16 feet long, with shorter pieces 4 to 8 feet to join with curves, etc. The rails are made of different weights according to use, such as 3, 4½, 6 and 8 pounds per linear foot. They are connected by steel sleepers riveted to the rails; 6 sleepers to each length.

gives more stability. These are the sleepers shown in Fig. 65; for ordinary work they are made flat. The gauges used are 16, 20, 24 and 30 inches, but for ordinary jobs of earth-work or building the first two are the most popular. Some 50 miles of 20-inch gauge are in use on the Panama Canal work. For ordinary building operations 1 to 500 feet are often employed for bringing mortar or materials to different parts of the building. The sections weigh from 116 to 300 pounds according to the gauge. The smaller gauge sections can be carried by a single man and the wider gauge by two men.

Curved sections and switches are all prepared ready to lay, as also iron turntables weighing only 200 pounds.

The wagons used consist of a truck made of iron, with four cast-iron or steel wheels, and the body varies according to the material to be handled. For ordinary contract work the form is that shown in Fig. 66. It is of sheet-iron supported on two trunnions at each end, which allow of its being tipped on either side by a slight effort, though it will remain in place even on a rough road. For light work these wagons will hold from 9 to 11 cubic feet. If horse-power is used for propelling the wagons, their capacity is increased to 14 cubic feet. For use in trains with locomotives the wagons are made to hold from 18 to 27 cubic feet. The same shaped body is also made with a grating in the bottom for transporting ballast for concrete, thus allowing it to be washed. Bodies are also made with a hook at each end by which to hoist them. When large stone are to be moved platform cars are used.

tionality, and it would be hard to say where it was first used. A few years ago a track known as the Peteler track was widely used in this country, but seems to have dropped out of the market. Our contractors seem now, however, to prefer buying light rails and suitable car fittings, and making track and cars to suit their own ideas.

We hope to describe some of the special plant that has been adopted in future numbers of these articles.

(To be continued.)

PORTLAND CEMENT—TESTS AT LONG DATES.

THE accompanying data, derived from the breaking of some 200 briquettes at dates varying from the original seven days' test to 410 days, and from that to 2019 days after gauging, are offered very tentatively, especially as regards the deductions drawn from them, but may not be altogether without interest.

The initial strength of the briquettes broken—that is to say, the strength at seven days after gauging—is by no means high; nor are the final results at any date such as are often secured, the minimum and maximum at seven days being 240 lbs. and 563 lbs. respectively, the greatest test obtained at any date being 700 lbs. per square inch of section; but this may be explained by the fact that the cement was not made to meet any high specification, the grinding was such as to leave a residue of 20 per cent., on a sieve of fifty meshes to the inch, and the gauging was done purposely so as to arrive at the minimum rather than the maximum result; and the same cement in other hands has always given tests from 20 per cent. to 25 per cent. or thereabouts, higher than those from which this statement is deduced. But though it is desirable that these facts should be understood, the comparative lowness of the tests in no way interferes with the general inferences which may be drawn, except that it may be considered that the limit of strength at seven days which gives the best final results may be raised somewhat when cement is tested so as to give out its greatest strength; and perhaps, instead of this figure being in accordance with these results, 538 lbs. per square inch of section at seven days after gauging, it may be increased to 650 lbs. or 670 lbs. for finely ground cement. But with this initial strength there is, in these examples, little if any increase in cohesion; indeed, in many cases, there is a falling off in this respect—which is, however, compensated for by increased strength in some cases. In eleven samples whose initial strength was between 500 lbs. and 600 lbs., six showed a loss of strength amounting on the average to 79 lbs. per sample, or 15 per cent.; while five showed an increase averaging 85 lbs. per sample, or 16 per cent.; or, taking all the samples into consideration, a loss of 1 per cent.

It will be noticed that cement with an initial strength of only 350 lbs. gives equally good results at 1076 days after gauging with that having an initial strength of 535 lbs. broken 686 days after gauging; and it is not probable that the increase of strength of any cement would be greater during the third and fourth year after it was made and used. All the samples of a less initial strength than 300 lbs. while showing an equal percentage of increase of strength, do not give anything like so good a final result; while above 350 lbs. initial strength the percentage of increase falls off rapidly, so rapidly that the final result is not so good as that having a lower initial strength. These tests seem to point to the use of one or two qualities of cement—namely, either that giving the maximum percentage of increase in strength, or that showing no increase at all in say three years in each case—the two qualities of cement being represented in the above samples; the first by that having an average initial strength of 330 lbs. per square inch at seven days, and the second by a cement having an initial strength of 535 lbs. at the same date after gauging. It is a nice question which to prefer, and the user must be largely guided in his decision by the purpose for which the cement is to be employed, whether the material can wait for the added strength to accrue. If this be the case, there seems to be little doubt that the cement having a comparatively low initial strength with a large percentage of increase should be preferred, for such a cement is decidedly more reliable, and there is no fear of its containing an excess of lime. The figures in brackets are those which may be considered to represent the full strength of the cement if tested in the most advantageous way, and are found by adding 22½ per cent. to the original figures.

Initial strength.	Average strength at seven days after gauging.	Average date at which samples in following column were broken.	Average strength.	Absolute increase or decrease in strength.	Average increase or decrease in strength per cent.	Average increase or decrease in strength per cent. per annum.
240 to 300 lb.	260 (318)	1463	430 (527)	+170	+65	+1.33
300 to 350 lb.	330 (404)	1076	545 (667)	+215	+65	+1.80
350 to 400 lb.	371 (454)	1595	469 (574)	+98	+27	+ .51
400 to 500 lb.	446 (546)	1044	450 (562)	+ 11	+ 3	+ .09
500 to 600 lb.	535 (655)	686	530 (649)	- 5	- 1	- .04

—REGINALD EMPSON MIDDLETON, M. Inst. C. E., in the *Engineer*, London.

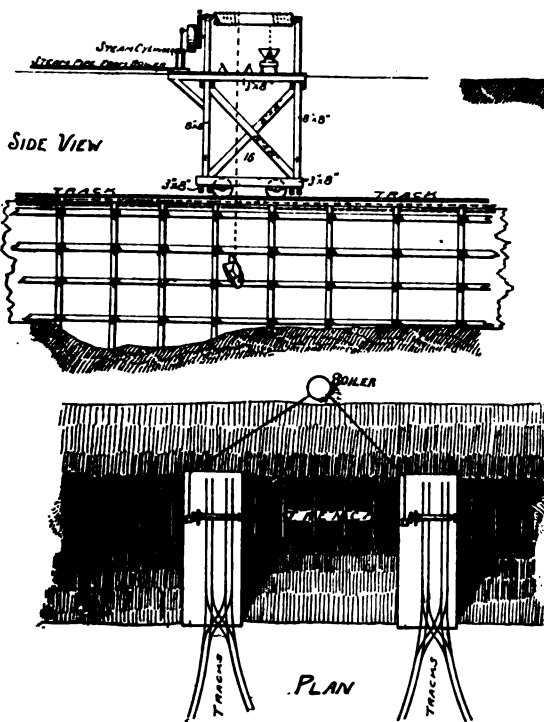


FIG. 65

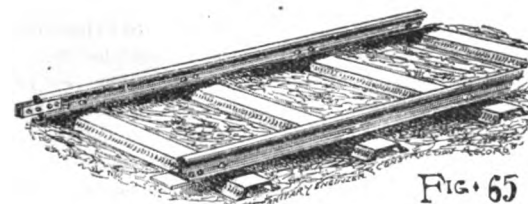
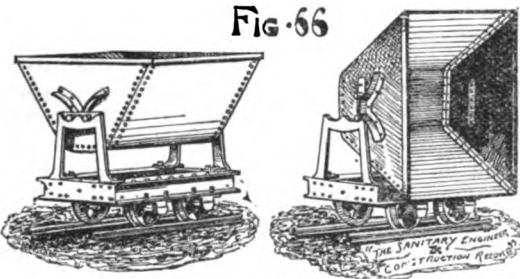


FIG. 66



Each rail has a pair of fish-plates riveted to one end and a steel shoe riveted to the bottom at the other end (see Fig. 65). In this way the different lengths may be laid together, and in many cases need not be made fast, being so much the more easily taken apart and relaid. When steam-power is to be used the sections must be bolted together. If the track is to be used permanently in one place for some time a special trough-shaped sleeper has been designed which projects 4 to 6 inches beyond the track and

Fig. 67 EXCAVATING APPARATUS —USED ON THE— TANCARVILLE CANAL AND SEWER

On the work of the Tancarville Canal and Sewer at Havre, France, there was an iron syphon laid below the bed of the proposed canal. It was for sewer purposes and formed of two sheet-iron pipes, 4 feet in diameter, laid in concrete. The canal itself was excavated by a steam-excavator, then a 5-foot trench was dug for the sewer. A pair of movable trestles were erected over the trench (Fig. 67) set to run on a track parallel to the trench and connecting with the bank on one side. The "Decauville" was laid on these platforms over to the bank and thence to the waste-dump. There were two tracks on each platform and trap-floors through which the dump-boxes could be raised or lowered, and a steam windlass for this purpose. A boiler on the bank furnished steam for both windlasses by means of flexible hose. In the more recent wars in Egypt, Afghanistan, Tonkin, etc., this plant has been extensively used for transporting troops and provisions; also in the African exploring expeditions the "Decauville," with platform-cars, was used for transporting steam-launches, baggage, etc. Last year Mr. de Brazza exhibited some of the features of his African expedition to the Congo, in the Hippodrome in Paris. There were 103 consecutive performances, in one part of which a "Decauville" is introduced. Some 500 feet of 20-inch gauge was laid each day by 20 sailors and then a train of 3 passenger-cars and a 2½-ton locomotive run over it with no accidents. This plant is rendering a great service to small contractors all over Europe and also in South America.

The use of portable track is not restricted to any na-

THE HASTINGS, ST. LEONARD'S, AND EAST SUSSEX HOSPITAL PLANS.

We are indebted to the *Builder* (London), from whose columns we have reproduced the plans of this hospital and obtained the following data. The architects were Messrs. Young & Hall.

Two schemes were submitted for the approval of the committee—one having wards of the usual form, the other having wards of a circular form, a system which owes its origin to the eminent surgeon, Professor John Marshall, F. R. S.

Several members of the committee and of the medical staff having visited the Miller Memorial Hospital at Greenwich, which (the first hospital with circular wards erected in this country) had recently been completed from the

them, and these lead to a broad balcony so arranged that the patients can be wheeled out into it in their beds. The mortuary and postmortem rooms are on the ground floor and isolated.

THE ARCHITECTURE OF LONDON STREETS.

The *Journal of the Society of Arts*, London, prints a paper read in the Art Section on May 10, by Edward J. Tarver, F. S. A., on the subject, "The Architecture of London Streets," from which we quote the following:

"In England, and especially in our large towns, where every one is free to erect buildings of whatever size he likes, so long as they are carried out in conformity with certain Acts of Parliament as to structural and sanitary conditions, it is hardly possible that each should know

"In the case of new thoroughfares, this would be easy enough, but I would extend this fount of information, as far as possible, to entire towns. The first duty of the officer in charge of this system should be to make himself thoroughly acquainted with his town, not only from maps, but by personal inspection of every portion—no light duty to begin with. I think I see him, mounted on a steady horse, wearing a coat with several outside pockets, containing his maps, note-books, and a sextant. Armed with these, he takes his town methodically in districts, and passes up and down every street. Of course he will pay most attention to the main thoroughfares, as they affect the pleasure of the greatest number of wayfarers in their daily route to and from their business. And I may say here in passing, that the new omnibuses, with their roof seats facing forwards, afford the most enjoyable way of contemplating our street architecture. A Hansom cab may or may not be a quicker conveyance in our crowded thoroughfares, but the view from one is nothing as compared with that from the top of an omnibus.

"To return, however, to the public officer. He will not neglect the smaller streets, for many of our most picturesque views are obtained in them, and besides, no one knows whether or not they may be removed or widened to make way for broader thoroughfares, which would throw into conspicuous prominence some hitherto concealed buildings. Where any important buildings exist, our officer will take a rough sketch of them in his book, or secure a photograph, and if he should know that there is any prospect of altering or widening the street, he will consider the most favorable point of view from which such buildings may be seen. A rectangular building, for instance, generally looks better at an angle than as seen straight in front of the spectator.

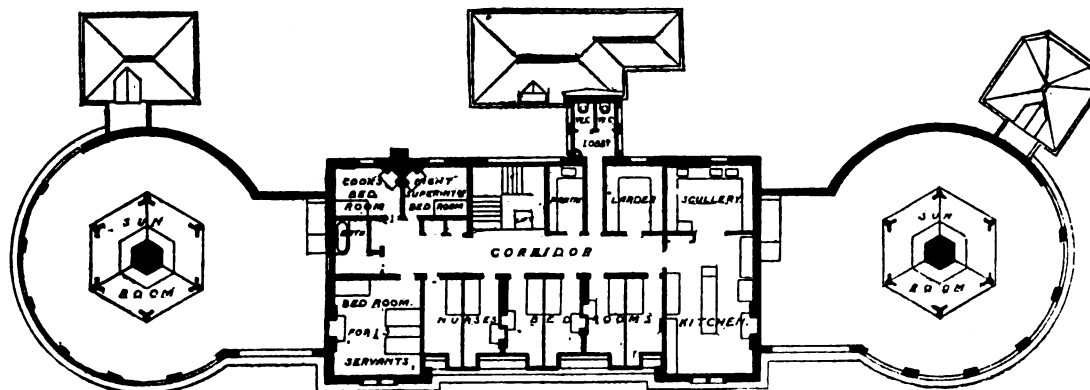
"But the more important buildings have to be considered, not only as seen from their immediate neighborhood, but as forming conspicuous objects from a distance. Here the sextant will be found useful, and the approximate height of every building that rises above the neighboring rooftops will be marked by our officer upon the Ordnance map which he carries about with him. The bench-marks already figured on the map will supply the remaining information as to the altitude of the spot above Trinity datum level. The effect of a distant building depends very much upon the intermediate levels of the ground beyond which it is viewed.

"In order to record the heights of important buildings in an easily comprehended manner, they will be marked in various colors upon a map already shaded in Indian ink, to denote the contours of the ground levels. For instance, all buildings over 200 feet high will be colored bright red; all over 150, purple; over 100, yellow; over 70, green; over 50, blue. These heights, added to the contour levels, will enable any one to see at a glance the part that such buildings take in the general landscape, and an architect about to build a tower will know whether 150 feet will be lost in a valley, or prove a mere waste of his client's money on a hill.

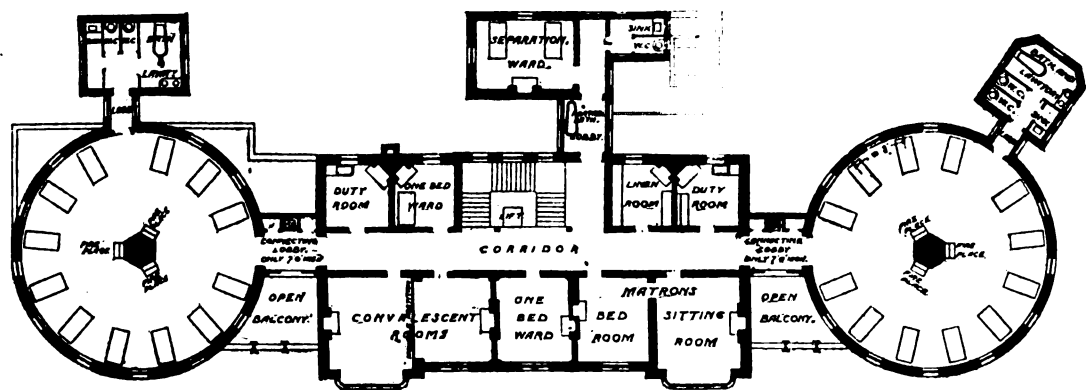
"As far as possible, it would be useful to have elevations of entire streets set up to a small scale; but the enormous size of some of our towns renders such vast labor out of the question. Fortunately, modern science comes to our aid in the shape of photography, and there are many streets which can now be recorded by the camera without very much distortion through a wide-angled lens.

"In order to obtain an idea of the actual appearance of the thoroughfare, the architect of any proposed building will naturally go and see it for himself; but supposing the land is eagerly taken up, and a hundred architects are all busy at work in their respective offices designing buildings of various sizes to be built on this thoroughfare, who can say whether the street, when finished, will make or mar the beauty of the town? It is here that I venture to submit that our public officer will be of real use.

"Let each architect, so soon as he has formed a general outline of a building that will suit his client's wants, send his design by a messenger to our officer. He will have one or two rapid draughtsmen, who will reduce to the required scale the elevation and the roof plan. The latter is most important, as showing the position of the chimneys, which affects street architecture more than may be generally supposed. The messenger will take back the plan in half an hour, so that the architect will not suffer from that most inconvenient state of being without his plans, which he is sure to want, if they are out of his reach for even a day."

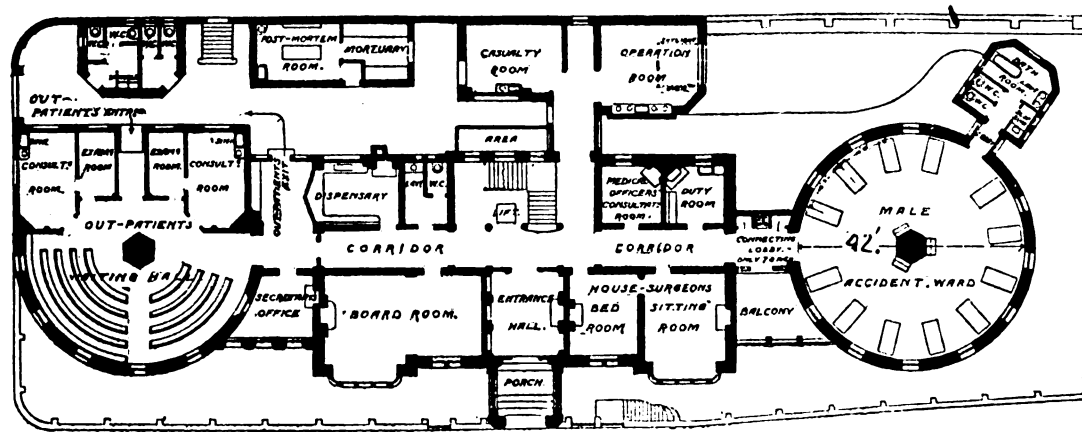


THIRD FLOOR PLAN



PLAN OF FIRST AND SECOND FLOORS

WHITE ROCK ROAD.



THE PARADE.
GROUND FLOOR PLAN.

design of Messrs. Young & Hall, the circular system was, after much discussion, finally adopted, and the designs from which the present hospital is being erected were definitely approved.

The building is planned to accommodate sixty-eight patients in five circular wards of twelve patients each, four wards of one bed each, and two separation wards of two beds each.

The central portion contains the general administration offices, with rooms for the resident medical officer, matron, nurses, and servants. The kitchen is placed on the top floor, and will be fitted with a complete gas-cooking apparatus by Messrs. James Slater & Co.

The wards are connected to the administrative department by means of corridors which are only eight feet high, so constructed as to allow a free current of air to pass over

what his neighbors are doing, still less possible that he should know what his neighbors are likely to do in the future. Nor would Englishmen submit to be bound down to build to one rigid line. Our liberty is too glorious a thing, when not abused, to be given up to a second Baron Haussmann.

"And yet, it appears to me, that it is possible to establish a system by means of which the individual architects of our new buildings should be enabled to work together for the common good, and for the prevention of clashing discords in our street architecture.

"As I said before, it is impossible for each man to know what his neighbors are doing; therefore, it should be the business of one public officer to collect all the plans that arise from time to time, and to record them in documents which should be accessible to all.

AMERICAN WATER-WORKS ASSOCIATION.

THE American Water-Works Association will hold its seventh annual meeting at Minneapolis, Minnesota, Wednesday, Thursday and Friday, July 13, 14 and 15, 1887.

It is hoped that City Councils and Boards of Directors will show their appreciation by having representatives in the association, and by sending items of information.

The approaching convention promises to be one of unusual interest and attendance.

The following is the programme:

Wednesday, July 13—Morning session, 10 o'clock. Opening addresses. Regular order of business. Afternoon session, 2:30 o'clock. Reading of papers: Ground water as a source of supply, A. C. Sekell; Water for public supplies, Colonel William Ludlow; Private water companies, H. F. Dunham; Revolution counters, Frank H. Pond; Recording gauges, Charles A. Hague. Evening session, 8 o'clock. Reports of special committees. Question box. Volunteered papers.

Thursday, July 14—Morning session, 10 o'clock. Reading of papers: Natural filtration, G. W. Pearsons; Legal relations, Consumers vs. Suppliers, A. A. Godard; Is water property? A. H. Denman; Reservoirs, open or closed? G. E. Beach. Afternoon session, 2:30 o'clock. Reading of papers: Filtration or subsidence, J. D. Cook; Local distribution of water, P. Milne, Jr.; Fungus or mossy growth, S. McElroy; Elevator indicators, J. N. Tubbs.

Friday, July 15—Morning session, 10 o'clock. Regular order of business. Adjournment.

The committee, with the citizens, have arranged excursions to various points of interest both in Minneapolis and St. Paul, as well as a trip to the lakes, and other social features.

The officers of the association are as follows:

President, B. F. Jones, Kansas City, Mo.; Vice-Presidents, W. L. Cameron, Memphis, Tenn.; H. G. Holden, Lowell, Mass.; J. M. Diven, Elmira, N. Y.; W. J. Milner, Birmingham, Ala.; Richard Holme, Denver, Colo.; Secretary and Treasurer, J. H. Decker, Hannibal, Mo.; Past President, Peter Milne, Jr., New York, N. Y.

Committee of Arrangements and Reception—Colonel John W. Henion, Chairman, Minneapolis, Minn.; Andrew Rinker, City Engineer, Minneapolis, Minn.; Colonel J. T. Fanning, Minneapolis, Minn.; L. W. Rundlett, City Engineer, St. Paul, Minn.; H. H. Harrison, Superintendent Water Works, Stillwater, Minn.

MINNESOTA ENGINEERS' CLUB.

THE club met in Minneapolis June 24. The secretary read the obituary prepared by the committee relative to the death of Franklin Cook. The secretary read an invitation to the convention of the American Society of Civil Engineers, and the club appointed President George W. Sublette a delegate. The president stated that one object of this meeting was to consider the feasibility of having an excursion. On motion of G. S. Houston a joint committee was appointed to assist the secretary in finding the wishes of the members regarding the proposed excursion and also those of the St. Paul club. The president appointed on the joint committee Messrs. W. W. and C. S. Redfield, and on the second Messrs. Houston and Cappel. On motion the president appointed Messrs. Cappel, Pike, Houston, Redfield and Pardee a standing committee on tests of materials, to confer with the State University authorities with reference to a series of tests of local materials to be conducted with a view of correcting the tables on strength of materials.

CALL FOR CANAL CONVENTION.

THE third annual convention for the purpose of considering measures for the improvement of the canals of the State of New York will be held in the Common Council Chamber in the city of Rochester, N. Y., on Thursday, the 28th day of July, 1887, at 11 o'clock A. M. All organizations of citizens in this State representing the commercial, manufacturing, agricultural, labor, and other interests, also individuals and public officials who favor the improvement of the State canals, are invited to send delegates. All individuals and delegates who expect to be present are requested to forward their names and addresses to Frank S. Gardner, Secretary, 55 Liberty Street, New York, as early as possible. The headquarters of the Executive Committee during the convention will be at Powers' Hotel.

THE State of New Jersey has obtained an injunction against the continuance of the work of building a bridge over Arthur Kill, or Kill von Kull.

SANDUSKY HARBOR.

FROM a report on this harbor made by Major L. Cooper Overman, of the U. S. Engineers, we have prepared the following statement:

The entrance to Sandusky Bay is about 40 miles from the western end of Lake Erie, and the Bay forms a natural harbor covering about 22½ square miles, with a depth of from 8 to 12 feet. The Sandusky River enters it at the south-west, some 14½ miles from Cedar Point. The present channel has been improved somewhat under previous appropriations, but it is crooked so as to require three sets of range beacons for its navigation and is 4½ miles long to deep water in the lake. It was intended to have 15 feet depth as being sufficient for the vessels navigating the lakes a few years ago.

The commerce of the city has since then greatly increased, as well as the size of the vessels; and it is now proposed to cut a channel which shall be shorter, straighter, and deeper, the width at bottom to be 200 feet and depth 17 feet.

Twenty-five thousand soundings were taken by Mr. Colby, the Assistant Engineer, and 75 borings made, all through the ice, showing an average cut of only 4½ feet and a favorable bottom throughout, and a saving of distance of 40 per cent. over the old scheme. The cost is estimated at 14 cents per cubic yard, or a total, including contingencies, of \$96,712. A consideration of the currents seems to indicate that the present eastern current will assist in keeping the channel clear, and the annual expense is placed at but \$5,000.

The revenue for 1886 was \$4,269; imports, \$40,231, and exports, \$222,058, with a rapidly increasing traffic.

In connection with the subject of harbors on the lakes, we are pleased to notice the transmission to the House of a resolution by the Lake Carriers' Association endorsing the project of a purchase by the United States of the Sturgeon Bay and Lake Michigan Ship Canal, so that it may be "a free passageway and harbor of refuge."

The whole country is interested in the proper development and protection of all forms of water transportation, and within reasonable limits, expenditures for this purpose by the general Government are wise and to be commended.

TRAINING SCHOOL FOR NURSES.

A TRAINING school for male nurses has been established at Charity Hospital, Blackwell's Island, under the direction of the Commissioners of Public Charities and Correction of New York, and a circular of information for applicants has been issued.

Those wishing to receive a course of instruction in this training school must apply to the Managers of the Male Training School of Charity Hospital, upon whose approval they will appear before the Board of Commissioners, and, if satisfactory to them, will be accepted as pupils in the hospital. The applicants must be between twenty and thirty years of age and must produce evidence of good moral character, be sober, and will be required to pass an oral, written, and physical examination. They will be under the authority of the Board of Commissioners of Public Charities and Correction. The Managers will have the power to decide as to the fitness of the orderlies for the work, and the propriety of retaining or dismissing them.

The term of service will be two years, during which time the orderly will reside constantly in the hospital, and will perform the duties of orderly in the various wards to which he may be assigned. He will receive \$12 per month during the first year, and \$15 per month during the second year, together with board and washing for the entire period of service.

At the expiration of the full term of two years orderlies will, after a final examination, receive diplomas certifying to their knowledge of nursing, their ability and good character, signed by the Commissioners of Public Charities and Correction, the President and Secretary of the Medical Board, and the Managers of the Male Training School.

Such an institution is needed, and those who hold such diplomas will not lack employment.

THE Contractors' and Builders' Board of Trade, of St. Paul, Minn., has elected officers for the ensuing year as follows:

President, Edward E. Scribner; First Vice-President, G. J. Grant; Second Vice-President, M. Breen; Third Vice-President, C. Lauer. These officers constitute the Board. J. H. Hanson was re-elected Secretary.

SWILL-MILK.

Science for June 10 publishes a letter on the subject of "swill-milk" from Prof. W. H. Brewer, of the Sheffield Scientific School, New Haven, Conn., as follows:

"By way of explanation, I may say, that, aside from my profession, I have been a member of our city board of health for about fifteen years, and its president some years, so have given the matter some thought; although there is no distillery here, and, so far as I know, no distillery milk sold in this city.

"I wish to add to the notes in this circular, that I have a decided opinion that swill-milk is unwholesome; but this opinion is founded on general facts rather than on specific proof.

"The following are among the facts inducing this belief:

"1°. That the health of cows affects the wholesomeness of their milk is proven beyond any doubt; and the health of cows fed largely or wholly on distillery swill is poor, as is abundantly shown by their general condition and by their high mortality.

"2°. It is well enough known that the food of cows affects their milk, and that their chief food largely determines its character. No one claims that distillery swill is the normal food of cows, or is wholesome food when fed in relatively large quantities. Odors of food (as of onions, etc.) show that some of the chemical compounds of the food go into the milk unchanged; and the same is shown by abundant experiment on animals. The experience with drugs (particularly the alkaloids, as morphine) with women in lactation is in the same direction, and is familiar to all medical men.

"3°. When swill-milk is undergoing spontaneous decomposition, it behaves differently from normal milk; it is usually acid when drawn, while normal milk is alkaline; it behaves differently in the processes for the manufacture of butter and cheese (and therefore probably also under the digestive processes)—so differently that creameries and cheese-factories refuse it. This is universal so far as I know any thing about them. I have heard this matter discussed by butter and cheese makers, and, so far as the general facts are concerned, I think there is no difference of opinion, that, where distillery swill forms a large or chief part of the food of the cows, milk is much injured for butter and cheese; the only difference of opinion being as to whether or not some may be used along with other food without injuring the milk.

"4°. We have abundant and sad proof that milk readily absorbs infections, and numerous epidemics of disease have been traced to this source. It also absorbs odors, and swill-milk stables are proverbially foul and stinking; so this doubtless adds to the possibilities of unwholesomeness.

"5°. These, with other facts taken in their connection, with the scattered and more or less vague data as to sickness in specified cases following the use of swill-milk, where this seems the factor most open to suspicion—altogether make me believe that, as compared with other milk, swill-milk is unwholesome.

"6°. I have never found any facts pointing in the opposite direction. Some are negative, others point in this direction. I know of none that point positively in the opposite.

"7°. The use of distillery waste for feeding cows has been more carefully and scientifically investigated in Germany (as I understand it), with the conclusion that it may be used in limited quantities, along with other food which forms the chief part of the ration, without injuring notably the milk. As I understand it, I may compare it with the use of turnips, cabbage, etc., which make the milk 'taste,' if fed in large quantities or at indiscriminate times, but which may be fed in limited quantities, and at certain times in respect to the milking, without flavoring the milk at all. I have often heard this matter discussed among farmers and milkmen, and, similarly, I think it very probable that some distillery swill may be used, regulated as to the quantity, the time of feeding, and the other food which goes with it, without practically injuring the milk. But because of the difficulties of supervising the production of milk for cities, and of controlling its sale, I would forbid, under heavy penalties, the sale of all milk in cities and towns, produced by swill-fed cows, whether much or little swill was used.

"I have made many inquiries among physicians on this matter, and I think the vast majority believe that swill-milk is not wholesome for children, and that this unwholesomeness is not merely negative, arising from its poverty in fat, sugar, or total solids, but that it has positively injurious qualities; and that, too, is my own belief."

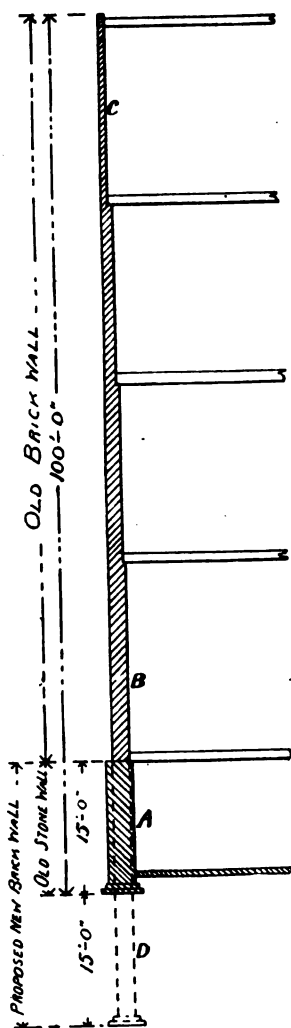
Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

BUILDING A WALL ALONGSIDE AN OLD BUILDING.

HOCHELAGA, June 16, 1887.

SIR: Having profited in the past from the information conveyed in the correspondence columns of the paper, I am tempted to submit the following building problem that has given rise to a discussion amongst builders here. It is desired to build alongside an old building, using the existing wall of said old building, but removing the foundation of stone on which said wall (of brick) rests, and substituting brick instead of stone, and going some fifteen feet below the level of the bottom of present stone foundation. Now, the question is, what is the best method for supporting the old wall while removing the present foundation, and rebuilding the new foundation under it? Of course, no injury must be done to the old wall, and the builders must carry on all operations from the one side of old wall, having no right of entry into the old building. Following sketch may make the question plainer. BUILDER.



A. Stone foundation 15 feet high, about 3 feet thick, to be removed.
B. C. Brick wall varying in thickness as it ascends from say 24 inches to 8 inches, to be supported without injury or going into old building.

D. Additional foundation going 15 feet below present foundation and to be carried up to top of recent stone foundation, which is to be totally removed and rebuilt in brick in line with recent brick wall.

[Our correspondent has a problem which is of almost daily occurrence in any large city, with this important exception that there is a legal right to enter the building for the purpose named: If we mistake not, in New York City an owner of a building is required by law to protect his own wall; in other words, he cannot prevent an improvement on an adjoining lot by making it impracticable to build a foundation to the depth required.

Of course, the very first thing in such a case is to properly brace the wall to be underpinned. Then suitable "needles" are inserted through holes cut in the wall, and wedges driven until the weight is taken off from the portion of the wall to be removed. The proper strain is indicated at once by striking the wall with a hammer. The subsequent operations of removing the wall, laying up a new one, and wedging with iron wedges between stones placed for the purpose, until the weight is thrown on the new wall, we presume our correspondent understands.

Now, if the requirement be *imperative*, that no entry be made to the old building, it complicates the problem, since all support must be from without. In this case vertical slits might be made and carried down to the full depth, and on a sufficient base at each a heavy post be placed, and one or more screw-jacks used to take the strain. Another method would be to use a heavy needle resting on a post (carried down *outside* of the wall) as a fulcrum and weighting the farther end to balance the weight of the wall. There will be a practical difficulty in wedging, but we can scarcely conceive the requirement to be so rigid that a man would not be allowed inside the building long enough to drive the wedges required. Should this be the case it would require a careful study, which had *best* be done by some person familiar with such work.

READY-MADE SPECIFICATIONS.

ALBANY, N. Y., June 21, 1887.

SIR: Can you furnish me with anything which will give a comprehensive specification for a good job of steam-heating for a large asylum building, part direct and part indirect heating? This is rather new to me and I want something which will serve for a general guide for good work.

Yours truly,

D. M. M.

[Such matter can only be obtained from a heating engineer who has had experience with this class of work.

As a general thing every building requires a special treatment and a general specification might lead to very serious blunders in the hands of persons who are not capable of reproducing one themselves.

In our advertising columns are the names of persons whose business it is to advise in such matters and who have had extended practice in designing heating and ventilating apparatus.]

Gas and Electricity.

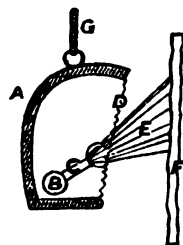
Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
June 25.....	28.50	21.26	21.62	29.03	28.60	25.49	30.15

E. G. LOVE, Ph.D., Gas Examiner.

A CORRESPONDENT of the *Electrician* gives the following account of the origin of the disastrous fire at the Théâtre National de l'Opera Comique, in Paris, on May 25:

It was about the end of the first act in "Mignon" when one of the gas-jets in the cross-light sputtered, owing to a shock which that particular cross-light received, due to some stage manipulation. The moment the light reached a sort of net decoration, in close proximity to the cross-light, the net caught fire like ignited gun-cotton. The decorations being so near the gas lights are always very warm and dry, so that they burn like tinder when lighted. The following is a little sketch in cross-section, which shows how the fire originated:



A is the iron frame of the cross-light suspended by ropes G. B is the main gas-tube, which has at regular intervals jets C; D is a sort of wire gauze, and F shows the decoration in front of the cross-lights; E represents the sputter which ignited the decoration F and caused the loss of so many lives and damage to property.

At Lyons the Mayor has issued a decree to the effect that in view of the recent deplorable catastrophe at the Opera Comique, all theatres, *cafe* concerts, and other public buildings in Lyons are, within five months from the present time, to be lit throughout by electricity.—*Electrician*.

THE Municipal Council of Vienna has decided on the conditions which must be observed in the establishment of electric lights in that city. According to these conditions, which are given at length in *Industries*, the contractor will be required to supply electricity to any householder on the lines of his cables, and even in adjoining streets when the demand is equal to five 16-candle-power lamps. The supply of electricity to all consumers will be compulsory from 4 P. M. to 1 A. M.; and when as many as 250 lamps are used by a private consumer, or 50 lamps by the municipality, the supply must be continued for 18 out of the 24 hours. Service wires are to be furnished by the contractor; but the internal wiring of houses will be at the expense of the consumer. The meters must be approved by the municipality or the Government, and the cost of any tests is to be borne by the contractor. The charge for meters has been fixed, and varies from 15 florins per annum for a 10-light meter to 40 florins for a 100-light meter. Each glow-lamp installed will cost the customer 50 kreutzers, besides which he will pay 4 kr. per lamp-hour for the current. Lamps of higher power than 16 candles will be charged for on the same basis. The standard to be used in testing illuminating power of the lamps is the Hefner-Altenack amyl-acetate lamp. Electricity for arc lamps, motors, etc., will be supplied according to private agreement between the contractor and consumer. The supply of electricity is not made compulsory unless the customer agrees to take it for at least one year. The municipality will get 25 per cent. discount on the above rates.

AT the meeting of the American Institute of Electrical Engineers, in this city, June 28, G. W. Blodgett, of Boston, electrician for the Boston and Albany Railroad, read a paper on "The Electric Lighting of Passenger Trains." His conclusion was that the most practicable way of lighting cars by electricity was by means of storage batteries or accumulators charged at terminal points.

PERSONAL.

PRINCETON COLLEGE, at its recent Commencement, conferred the degree of Civil Engineer, in course, on F. F. Bedle, of New Jersey; T. O. Blackwell, of New York; F. W. Jackson, of New Jersey; C. L. Riggs, of Maryland; and Dr. Walker, of Utah.

M. M. GREENE, former President of the Columbus, Hocking Valley, and Toledo Railroad, died at Columbus, O., June 26, aged fifty-seven years.

W. G. GILBERT, Civil Engineer, of Walton, N. Y., has entered the employ of the Chicago, Santa Fe, and California Railroad Company.

THE following changes in the stations and duties of engineer officers, U. S. A., will take effect July 1: Major David P. Heap will report to the Secretary of the Treasury as Engineer of the Third and Fourth Lighthouse Districts; Captain John C. Mallery, on being relieved by Major Heap, will report to the Secretary of the Treasury as Engineer of the Fifth and Sixth Lighthouse Districts; Major James F. Gregory, on being relieved by Captain Mallery, will report for duty as Engineer Secretary of Lighthouse Board, relieving Major D. P. Heap; First Lieutenant John Millis, on being relieved as Engineer of the Third Lighthouse District, will report to Major Heap for duty under his orders; Captain Millard Young, relieved from duty under Captain Charles F. Powell and ordered to duty at Portland, Oregon; Major Joseph P. Farley, Ordnance Department, detailed as a member of the board for testing rifled cannon, vice Captain Charles Thaler, relieved; also in Quartermaster's Department, Major E. B. Kirk, Quartermaster, ordered from Atlanta to Fort Sumter, S. C., to inspect Ordnance Sergeants' quarters being erected there; Major David Perry, Sixth Cavalry, ordered to assume command of the recruiting depot at Jefferson Barracks; Captain A. P. Blunt, Assistant Quartermaster, granted two months' leave of absence; First Lieutenant John T. French, Jr., Fourth Artillery, granted leave of absence from July 15 to September 19.

MR. JAMES S. MARTIN, of Atlanta, and Mr. W. Chamberlin, of Cincinnati, have formed a partnership at Memphis, Tenn., as civil engineers and architects.

CONVENTION OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS.

(Continued from page 102.)

THE reports of the State Vice-Presidents were as follows: Connecticut led off—Vice-President Robert Morgan, New Haven, stating that "no progress had been made in establishing new associations, yet we are more prosperous than ever before. The membership is good and all are enthusiastic. We are trying to get some sanitary measures passed by the Legislature and have met with considerable encouragement, and think we will have a law regulating plumbing before the present year is closed."

District of Columbia, by Vice-President E. J. Hannan, reported the association now numbered only fifteen, out of one hundred and forty plumbers in Washington. However, the second association that had been formed amounted to nothing.

Indiana was passed for the present, Vice-President J. Giles Smith having removed to Wichita, Kan. Later, James Madden, Fort Wayne, the one Hoosier delegate present, said the association had "lighted up in Indiana only to be extinguished in a short time." A New York closet had been given exclusively to one Fort Wayne plumber who charged the speaker as much as any other party, whereat the speaker kicked vigorously.

Executive Committeeman—That will come under review by our coming committee on protection.

Kentucky—William H. Matlack, Louisville, Vice-President—stands now about as last year. However, we see gleams of revival, and now and then we still hope that our local association will arouse renewed interest.

For Kansas: We have increased our membership here and there, and are much encouraged.

In Maryland, Thomas J. Griffin, Vice-President, reported on the situation thus in the course of a pamphlet report: Our Baltimore association has been increasing rapidly. We have now two additional delegates here and will increase the number still more at the next convention. No new associations can be reported, because there are not more than two or three plumbers, if so many, in any outside town, but we have induced two or three plumbers from the country to join the Baltimore association. The law relating to the examination of plumbers went into effect May 1; 296 certificates have been issued and forty-nine rejections. The Baltimore Resolutions work all right and we are a unit in their favor, unless your honorable body bring forward something better.

In Massachusetts, Vice-President D. G. Finnerty reported no new independent organization, but the Boston membership had risen the past year from 82 to 150—all in good standing [applause]. This increase had come largely from the small cities and towns of the State. Relations with manufacturers and dealers in plumbers' supplies had been very satisfactory and no interruption had taken place from strikes or labor troubles whatsoever.

In Minnesota, said Vice-President Sergeant, of Minneapolis, the local associations of that city and St. Paul are in a prosperous condition. The health boards and the press of the twin cities co-operating, some marked sanitary advances had been secured, and the next Legislature will be appealed to further. However, manufacturers sold to any buyers at about the same figures as to plumbers, and half of the craft were not members of the association, but the creatures of the wholesale dealers who refuse us any favors whatever.

"New York!" called the Secretary, but Vice-President George Cummings was not in the room, and the chair called on Mr. Gabay, who deprecatingly said that Mr. Byrns, "that zealous and noble worker in the great fight we have had," had better be called on. The large amount of work we have had in New York has made it very difficult for the members of the New York Association to assist Mr. Cummings in organizing local associations through the State. We have had our hands full, as you all know, with that very great fight that we have had. In the course of that fight I had occasion to go to one or two of the neighboring towns—as far as Albany at one time—and found their association there had been successful in a strike, and was in a very prosperous condition. It is not needful to go into a synopsis of our own fight—you know its results. It has lasted ten months, and still there is a little lingering work, but as they haven't succeeded at all from the beginning, we haven't the slightest idea that they will have a better time of it.

Mr. Marrin, of Brooklyn, thought Mr. Cummings would have reported, "but for the well-known condition there."

Pennsylvania was called, but Enoch Remick had gone for lemonade, accompanied apparently by his colleague from New Jersey.

Rhode Island's Vice-President, Patrick Tierney, was likewise quaffing the cooling draught.

Wisconsin and W. E. Goodman said the latter had no report to present.

Michigan, too, had the familiar story of strikes. "The Master Plumbers' Association of Detroit are not opposed to any organization that our men may see fit to enter, but we do protest and shall combat against any organization that combines to take away the right of their fellow-men." [Much applause.]

W. E. Foster made a humorous and truly eloquent speech for Virginia, refusing to take the platform, as he must stand by his standard there, as no one else would. He was sorry to say that Virginia had no report. He himself constituted the Masters' Association of the State, being the only member thereof.

The Chair—I will answer for Ohio, as Mr. Rickets, the State Vice-President, is in poor health. We have tried in

my own city of Cincinnati to do all that could be done for points outside.

Missouri was not quite ready to report.

In Nebraska Vice-President D. O. McEwen reported 19 members at Omaha, 12 recruited in the last two months. Lincoln had three members, Beatrice one.

Essays being called for, Mr. Stevens, of Boston, chairman of the special committee, said the list had been duly handed to the Executive Committee.

The Chair—The Committee on Essays have confined members to five different subjects—five important ones—points taken up by medical experts and others, and even by the National Health Board itself. It was thought best to confine ourselves to those five subjects, so that they may be properly discussed here and some sort of decision arrived at as to what is best. For instance, is a trap on a main drain necessary? There is quite a conflict of opinion on that point, and it was in order to bring out the opinions of various localities as to that matter that the subject was chosen. There are several papers presented here, and I await your order as to which to take up first.

Then followed the reading of an essay, entitled "Multum in Parvo," by J. J. Wade, Chicago.

On motion of Mr. Macdonald, New York, the recommendations of the essay were referred to the Executive Committee.

The next essay was by Richard Murphy and J. A. Gibson, Cincinnati.

The paper argued for trap on main drain, and for fresh air inlet opening from the attic, and opposed the present system of ventilation.

Mr. Foster, Virginia, discussing Mr. Murphy's paper, said: "This paper presents a startling idea that may revolutionize the plumbing practice of the country. We possibly understand the hydrostatic paradox that two columns of water, if connected at the bottom, will rise to the same level; and if that is so, why will not two columns of air, which is but a modification of water, composed of the same constituents—why will not they rise to the same level where there is a lack of circulation? Now, take away the hot-air flue, by reason of the fact that the chimney is not in use, and then a matter of fact presents itself parallel to the hydrostatic paradox. In view of the fact, that there may be great import to the proposition, and that it may revolutionize our ideas entirely, I move that it be referred to a special committee of five, of our most intelligent members."

The Committee of five was voted, and the chair named Messrs. Cochrane, Stevens, Moylan, Cauvette, and Tate.

J. Giles Smith, Wichita, Kan., read another paper on the same general subject.

The Apprenticeship Committee reported in favor of adopting the New York Master Plumbers' Association rules on apprenticeship.

Alderman McCoach, Philadelphia, didn't want such an important matter hurriedly decided. The resolutions should be printed and slips provided early in the morning, which was agreed to.

Adjourned till 9 A. M.

SECOND DAY.

The second day's proceedings opened at 10 A. M., President James Allison in the chair.

Delayed reports for States being in order, that for Illinois was presented by Vice-President P. J. Kane, of Alton. He announced the forming of a State Association and one local association with about twenty members. He had received very encouraging replies to his letters sent out through the State, and before the next convention every master plumber would be in the ranks. Our local association is in a very prosperous and healthy condition and is still largely increasing in membership. Mr. Ryan, of the Chicago association, has introduced into the Legislature a bill for the regulation of plumbing and house-drainage in the State of Illinois, and it is expected to pass at the next session. Report accepted.

Ex-Alderman Ryan, Chicago, who introduced this bill, asked for an expression from the convention recommending the passage of the bill.

Mr. Hannan—I move that the convention endorse the bill. Numerously seconded.

Acting Secretary Weaver read the bill and it was unanimously endorsed.

The Financial Secretary announced the arrival of a new delegation headed by George Kendall, of Clinton, Iowa.

Then a paper was read, presented by the New York delegation, on "Trade Schools and Technical Education in their relation to the plumber of the future."

Rupert Coleman, Chicago—Let the paper be referred back to the New York association with the request that they bring into action the suggestions they make to this association.

Alderman McCoach, Philadelphia—Some points are so valuable they should go to the Executive Committee. They touch on a matter more important in my mind than the chance trade school—I mean manual training in our public schools. In Philadelphia we are moving for that, and I have advocated it ever since I have been a member of the city government.

A. Young—The essay just read receives, I am sure, the unqualified endorsements of the National Association now assembled, and I move that steps be taken by the coming administration to put the subject of practical manual training into effect in every State where our association exists.

Mr. Weaver—I second that, for we have struck the milk in the cocoanut. Form your trade schools and you will have no strikes, but better boys. Follow out the system, and at the next meeting of the convention elegant results

will have come from the different local associations establishing their schools. New York has the model school. Five years ago when the school started, the suggestion was made to New York plumbers to take a hand. They were not ready for it then. The times have ripened. We have had our difficulty with the workmen, and all have now taken hold of the good work which Colonel Auchmuty started some seven or eight years ago, and the result is this essay presented here to-day—the most important work of the convention [applause.]

The Chair—I think you all know my position with reference to education and trade schools and I need hardly reiterate my endorsement. Do you approve this motion instructing every local association to start one if possible—in a small way, it is true—but still to start it? Carried, with enthusiasm.

Mr. Macdonald, New York, referred to Colonel Auchmuty's generous financial support of the work, and proceeded: "As a member of the Examining Committee I found great pleasure in examining the boys, who, for five months gave their time to using the tools. The questions asked them were published in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, of New York. Our association in New York furnished a diploma to each boy, and that entitles the boy to one year on his apprenticeship. Let trade scholarships be established so that local associations can send representatives there. I move a vote of thanks to Colonel Auchmuty for the noble work he has performed in establishing the New York trade school."

A. W. Murray, Chicago—In seconding the resolution, I would amend by making Colonel Auchmuty a member of our National Association for all time. Both propositions went through with applause.

John Griffith, of the Chicago Entertainment Committee, announced a boat ride on the lake in the evening and a visit to the training school late in the afternoon.

After considerable discussion both appointments for pleasure were approved, and by way of preparation a continuous session till 3 P. M. was voted.

Copies of the report of the National Association of Builders, with declarations of principles, were distributed through the convention and elicited a formal vote of thanks.

At this point the Sergeant-at-Arms lifted up a vigorous wail—the sheep were all going over the wall.

First Vice-President Trainor (in the chair)—I suggest that if the gentlemen want a drink so badly, we take a recess or have the punch-bowl brought in. [Laughter.]

The report of the Apprenticeship Committee was read by the chairman, Mr. Harkness, Philadelphia, and recommended the adoption of the New York code. A long discussion, the longest of the convention, at once set in.

A. Young—I move to adopt the thirteen resolutions, just read, as a whole.

Objection was raised and they were taken up seriatim, the first hitch being on Section 3.

Mr. Rothrock, Baltimore—I consider it bad practice to employ boys who are not apprentices—a course which that section approves by implication or at least recognizes officially as existing. Boys, when employed, shall be taken as apprentices and for the full term.

Mr. Phillips, Providence—It is these helper boys, taken and discharged at will, who go out and disgrace the trade. Let us restrict this evil just as far as possible.

Mr. Dewstoe—In ordinary times we can get along with our regular apprentices, but during rushes helpers are indispensable.

Mr. Rothrock—Then employ men [applause] day-laborers.

Mr. Dewstoe—The great difficulty is that young men go out after one, two, or three years and get full wages—not by merit, but by the acts of trades unions. I grant it an evil, yet in a trade like ours, which has very busy seasons offsetting the dull ones, we must have extra help.

Mr. Rothrock—It is true that laboring men cost a little more than boys, but we should ourselves make some sacrifices for the good of the trade in general.

Mr. Zumbusch, Jersey City—We can't employ men-helpers, because they will set up almost next day as competitors.

Mr. Reynolds—Sometimes we are compelled to hire fifteen or twenty-five boys. How can we apprentice that many? Impossible!

Mr. Macdonald, New York—The old argument against the American boy. A good boy will come to the top. But for the laborers that we have brought up in New York where would we have been in the last trouble? The journeyman said they would not under any circumstances tolerate a laborer. Don't hamper the American boy, be he whom he may, who wishes to learn the trade.

Mr. Weaver, Philadelphia—By the Deer Park rules the apprentice is apprenticed, in effect, not to the individual, but to the entire association of a city, his time being charged up on each account, the boy uninterruptedly advancing to the journeyman's dignity.

Finally the clause objected to—"boys in his employ who desire to become apprentices"—was stricken out from Section 3, and all was plain sailing till Section 10 was reached, when Mr. Finnerty, of Boston, objected to the clause. "When he (the employer) finds it necessary to dispense with the services of any apprentice." No apprenticed boy, he held, should or could be laid off at any time. If it merely meant, as one explanation had it, to ask a brother employer to find employment for his apprentice, even then it was about time that No. 1 shut up shop. When an apprentice was taken he should be retained until the time of his service was completed; any other apprenticeship was a farce.

Mr. Cochrane, New York—I don't believe there is a bound apprentice in the city of New York—there may be a few who come across daily from Jersey—and the helpers are just as faithful as apprentices.

Mr. Phillips joined in criticizing the section and Mr. Dewstoe approved it. "In fifteen years," said the latter, I have never discharged an apprentice, yet I don't want to stock my shop with labor—any more than with bath-tubs—for five years to come. While no man would discharge an apprentice unless absolutely compelled to, he don't want to bind himself down by a cast-iron rule. The boys haven't a better friend than I have been and am, but they have to take the chances of trade just as we do."

The criticized section then carried with but few negatives.

Next, Section 12, which prohibits an apprentice from joining any trade or labor union, was questioned by a Kings County, N. Y., delegate.

Mr. Gabay, New York—Why do the journeymen unions want the boy to join their association or the junior associations? That is the question each member wants to ask himself when he votes on that section. When he does so, he will vote for it. It is not to benefit the boy, and it is only to injure the employer. When the boy becomes a proficient mechanic and has completed his apprenticeship, then if he desires to join any labor organization, that is his own business, and I am sure no gentleman in this room objects to what organization he joins so long as he does not encroach upon the rights of the employer. But the reason they want the boy is simply that when they declare a strike they may leave your shop without a soul in it. And if they could have done that successfully in New York what could our association have done and where would the plumbing trade of the United States have been to-day if it were not for the noble stand of the New York association? [Great applause.] That was the only salvation the New York association had. [Applause.]

J. J. Hamblin, Chicago, Chairman of the Apprenticeship Committee, being called to take the floor, said the first apprenticeship legislation in the association came from Chicago, and at his instance, he having been set to thinking by his own idle apprentice days in New York under J. P. Quinn, when he played off sick about half the time, really running up and down the Hudson having a good time. The Chicago system works well. "I have to-day sixteen boys in my employ, though one-half are sitting on the bench idle on account of the strike. I have had boys go into the country after two or three years' service, but that time does not serve as apprenticeship work. It is different if I transfer them to another shop—then the time counts. There you have the system in a nutshell, the boy being apprenticed, not exclusively to me, but to the trade here, and every hour's work advances him on his way. I don't see what all this hesitation means—the thing certainly looks very simple to me."

The section passed unanimously.

Mr. Gabay—Does this affect boys now in an organization or not? Does it mean we are to request the boys to resign? [Voice—"And if they won't, bounce them?"]

The concluding section, No. 13, providing that "no employer shall take any more boys as apprentices than he can properly educate and keep permanently," was attacked on all sides. G. S. Paine, Cleveland, wanted to strike it out; Mr. Rothrock defended it, Messrs. Weaver and Dewstoe took a hand, and R. Coleman, Chicago, said: "Employers in taking boys should use their best endeavor to keep them through the whole term of apprenticeship. 'I go farther,' said 'Boston' Finnerty; 'it is his imperative duty to do so; to abridge an apprenticeship is a contradiction in terms, and to transfer one unless you yourself also leave the establishment is not much better."

T. C. Boyd, Chicago—I offer as a substitute for Article 13 the following: "If a master plumber is compelled to discharge an apprentice for want of work, it should be his duty to provide employment with another who has work for him, and can teach him the trade."

Mr. Weaver—I would suggest to put in the following: "Should the employer refuse to give him a recommendation he can appeal to the Apprenticeship Committee of the local association."

Mr. Whitelaw, New York (with some warmth)—It seems to be the standing order to have a discussion on the apprenticeship matter. Some say, don't hire any except bound apprentices. Where would we be in New York to-day—a vital question touching us all, and that may well be repeated—if it were not for these same apprentices that were not bound? Can we keep a boy who is intelligent from learning the trade if he is not bound? He can learn it in spite of the master and in spite of the journeyman, even as a helper. We make a mistake if we go to work and have bound apprentices. "We will make you come to it," the journeymen have been threatening; "we will make you have one apprentice for each four men." We say: "No; we will hire and discharge as we please." We have fought that thing out for ten months—ten long and weary months, and here, apparently, we have to fight it out again, for what else is the meaning of this two hours' discussion. Show me where it is any benefit; show me where we are going to help ourselves by having these bound apprentices, or help them either! The great majority of you gentlemen in this room were never bound apprentices, but picked up your trade, I suppose, in perhaps a half-dozen shops. Do you really want to have this bound-apprenticeship system—have slaves, if you please? In the city of New York, to the best of my knowledge and belief, I think there is only one shop on the whole island that has bound apprentices—Thomas J. Byrne. That is the only one I think of. Did he, by having his bound appren-

tices, assist us in this matter? Far from it, gentlemen. He was one of the first ones to go against us, for all he said in this convention advocating things that I thought at the time were entirely wrong. But after these two hours why continue to discuss this chestnut! [Applause and laughter.]

John Byrns, New York—I desire to say that I am not the Byrne of New York who has the bound apprentices. [Applause.]

The Boyd substitute was then carried.

And then the thirteen sections as a whole were adopted unanimously as a substitute for the previous apprenticeship law of the association.

These resolutions are as follows:

1. The term of apprenticeship at the plumbing trade shall be five years.
2. No boy shall be taken to learn the trade until he has attained the age of 16 years.
3. Each employer shall be required to make a return to the Apprenticeship Committee of a list of the boys in his employ as apprentices, with their ages, places of residence, time of commencing at the trade, etc., and a general record of each boy.
4. The Secretary of the Apprenticeship Committee will keep an apprentices' record, in which will be recorded the name, address, and age of every apprentice, with date of commencing and discontinuing work with each employer.
5. For each apprentice so recorded the secretary shall issue an apprentice certificate to be sent to his (the boy's) employer to be retained by him so long as the apprentice is in his employ. When the apprentice takes service in another shop the certificate is given to his new employer to be filled in with the date of commencement (of service) and so on until the certificate shows that the proper time has been served.
6. Any boy wishing to learn the plumbing trade will be required to send his name and address to the Secretary of the Apprenticeship Committee, who will notify the applicant when to appear before the committee for examination. Each applicant must have a letter of recommendation from a member of the Master Plumbers' Association.
7. A beginner at the trade will be required to work six months on probation, at the end of which he shall appear before the committee for re-examination, and if found worthy his certificate shall be issued; he shall be recognized as a regular apprentice, and the time already spent at the trade shall be allowed on his certificate.
8. When the five years shall have been served, the apprentice shall be presented by the association with a diploma, showing the date of service and signed by the president of the association and by the Apprenticeship Committee.
9. Boys having a diploma from any trade school shall be allowed a deduction of the last year from the term of apprenticeship.
10. It shall be the duty of each employer when he finds it necessary to dispense with the services of any apprentice to report to the secretary the names of such apprentice at least one week before laying him off.
11. It shall also be the duty of the members of this association to apply to the committee when in need of apprentices.
12. No boy shall be allowed to join any trade or labor organization during his term of apprenticeship under penalty of forfeiture of his certificate.
13. If a master plumber is compelled to discharge an apprentice for want of work, it should be his duty to provide employment with another who has work for him and can teach him the trade.

The Committee on Resolutions then submitted its recommended list, as under:

No. 1, by the Philadelphia delegation, requesting that master plumbers throughout the country shall be ranked as dealers by the manufacturers of terra-cotta pipe.

Henry Smith, Philadelphia—Are we not starting a boycott principle? We say to Knights of Labor, "We won't allow you to dictate to us," and here we go right around and discriminate against our own fellow-craftsmen.

Mr. Hannan—We simply request the dealers, and we only speak of ourselves, of course.

Mr. Sullivan—All plumbers, whether in the association or not, desire the benefit of our victory.

Mr. Smith—Let the words be inserted, "All plumbers of the country be classed as dealers," etc.

Mr. McCoach—There is no boycott. The manufacturers raised the price twenty-five and fifty per cent on the plumbers, but not on the others. Make us like the others.

Mr. Macdonald, New York—I would suggest "all plumbers' material," instead of "terra-cotta."

Mr. Whitelaw—And I would substitute the broad word "dealer."

Mr. McCoach explained the circumstances leading up to introducing the resolution.

Mr. Byrns—As Chairman of the Committee on Resolutions, I hope the proposed substitute of "dealers" will not prevail. We are here to legislate for the men connected with this national organization and for no other man. As to the intimation of the gentleman from Philadelphia that we are attempting to boycott somebody, there is nothing of the kind; we are legislating for our constituency. There are good reasons why the clause referred to should be left as it is, but which it is probably not policy to explain on the floor of this house. [Applause.]

Mr. Macdonald—I hope the committee will accept the words, "all plumbers' material." Terra-cotta is nothing in our city to what we want. [Voice—"Putty!"] Yes, putty. [Laughter.]

Mr. Byrns—The committee accepts the substitute of Mr. Macdonald. [The latter—I thank the committee.]

Mr. Sullivan—Also the words, "all plumbers." I make that amendment.

Mr. Byrns—I move that we lay the amendment of Mr. Sullivan, of New York, on the table. Carried.

Then the original resolution, as amended by Mr. Macdonald, was passed.

The Committee on Resolutions then reported unfavorably on the paying of the principal officers, but recommended instead the payment of a Grand Secretary under a salary to be fixed by the Executive Committee, who shall devote his whole time to the duty of the National Association under the direction of the president. [Chorus of approval.] The Grand Secretary would not take the place of the Secretary.

The Hudson County, N. J., delegates opposed all salaries. All our delegates are not here because we could not afford it, and we certainly cannot stand additional taxes. Volunteers will take the place for its honors.

Mr. Cochrane favored it; also Mr. Macdonald, who, as a member of the Executive Committee, had seen the necessity for such a paid officer. We know what money did in New York City—it was sink or swim there, and we were willing to put our hands in our pockets, and we are willing to pay well for what is before us.

Mr. Byrns—The remarks from Hudson County, N. J., recall the fact that Newark, with a population of over 100,000, and a large number of plumbers, is not represented here, and the object of appointing this secretary is just here, to build up our organizations in such places as that where it is needed. At the beginning of the New York strike we employed a clerk on a salary, and he paid for himself twice over by the number of new recruits he secured and the supposedly bad debts he collected. And we have a large number of ornamental vice-presidents throughout this country [applause]. New York State should have not two but ten associations of master plumbers. Buffalo, with over 200,000 inhabitants, is not represented here; Syracuse, Rochester, Albany, Poughkeepsie, Troy, Utica—all those cities will be here [applause]; and if we get a good man—call him Grand Secretary, for that gives him title and dignity, and that goes a great way in this country [applause]; we will call him "Grand" if it doesn't cost anything—you will find that it will pay. There will not be a dollar of additional taxation on the associations; our membership the first year will run up to 250. Adopt the resolution. It is left to safe hands—in executive officers selected by yourselves. Hudson County itself will thank us. [Applause.]

Hudson County—It burst our bank to get here; no more taxes. Our association numbers twenty-six, both poor and lukewarm. We paid our own fare here, but with increased taxation we will have no one to represent, for we cannot carry the expense of the whole affair on our shoulders.

Mr. Paine, Cleveland, favored the Grand Secretary heartily, and Mr. Macdonald, New York, likewise; also Mr. Weaver and Alderman McCoach, the latter being won over by the eloquence of the arguments, and willing to go right down then and there to help poor Hudson County to the next convention. [Applause and general good nature.]

President Allison—The Chair, not to enter on any argument, could tell you good reasons why we need new ways and means to set forward our work.

The post of "Grand Secretary" was then created unanimously.

Resolution 3, by the President, recommending to local organizations to provide for the education of the coming plumber by the establishment of trade schools, reading-rooms, lectures, etc., was carried without discussion.

Resolution 4, by the President, recommending that contracts for plumbing work be made direct with owner or architects, was similarly carried.

Resolution 5, approving of the union of the New York Master Plumbers in their battle for the boys, passed unanimously.

Resolution 6, reaffirming the declaration of principles adopted by the National Builders' Association, passed unanimously.

Mr. Dewstoe—We should have some plan by which local associations can stand by one another in case of difficulties; as, for instance, the Cleveland strike.

The Chair—I think the committee understand about what is desired in that matter.

Resolution 7, recommending to the Executive Committee to consider the feasibility of establishing purchasing agencies, was approved by the committee.

Mr. Gabay—I hope that won't be adopted. I don't see why this association wants to go into the business of material dealer and supply house and become a co-operative society.

Mr. Hannan—Your Executive Committee have good reasons for its recommendation.

The Chair—We were all for it.

The resolution was adopted.

Resolution 8, constituting the State Vice-Presidents so many committees of one, as it were, to hear or receive complaints in their respective States of any violations of the protection rules by dealer, master plumber, or manufacturer, was recommended for adoption.

Mr. Whitelaw wanted the duty devolved on the Grand Secretary.

The Chair—It is an assignment that meets some complaint as to the State Vice-Presidents. I have always held in my own mind that the office was not what it should be, because, while desiring something to do, it really had very little to engage its attention. Now the gentlemen will know what they have to do.

The resolution was carried, as were the resolutions, then, as a whole.

The report of the Committee on Essays was presented by Martin Moylan, who said: "Your committee, to whom was referred the consideration of trap on main drain, etc., discussed in Messrs. Murphy's, Dunnett's, and Smith's papers, beg leave to report that while recognizing many important features, points and suggestions recommended by Messrs. Smith and Dunnett, they approve that system advocated by Mr. Murphy, except soil and waste pipe terminating between roof and ceiling, which we recommend in all cases to be continued above the roof, the vent to be carried at least five feet higher than the inlet-pipe, the cap without a ventilator."

Mr. Gabay moved the report be received. Carried.

The Auditing Committee reported the treasurer's report correct.

The State Vice-President of Missouri reported an eventful year, marked by labor troubles, but that the St. Louis association is now stronger than ever, having 113 members. The rivalry among jobbers and manufacturers makes it a difficult matter in outlying points to operate the protection policy, new arriving firms selling sometimes to outsiders. The Kansas City association has twenty-eight members; twelve added in six months, with five applicants throughout the State. Our relation in St. Louis to the supply houses is of the most friendly nature.

Quite a wrangle followed between Delegate White, Denver, and the Missouri vice-president. The former was supported by Delegate McCarthy, Denver, who said: "We want some support in the fight we have undertaken in regard to the Baltimore Resolutions. You have got to support the plumbers in this National Association if you want to have a National Association."

Mr. Finnerty, Boston—Regarding all that, the convention last year voted local option to the association.

The Chair—Yes, to make the best terms they could.

An Officer—This belongs to the Protection Committee, and it is proposed to take these matters more actively in hand, this kind of business being mapped out, and one man secured on a salary to give his entire time to it, seconded by vigorous vice-presidents.

Again St. Louis came to the front for another half-hour, this time the central name being J. P. Gallagher, of that city, who, it was developed, had sent in an essay without home endorsement. Major Foster, Virginia, in the name of courtesy, wanted a reference to a committee.

Major Foster's resolution was tabled and the essay ordered returned.

A. Young—If under our present government we haven't power to aid local associations when in distress, let us now know it. How was it in New York, Mr. President?

The Chair, alleging modesty, asked Mr. Byrns to answer. "I have no doubt," replied the latter, "that the National Executive Committee did all in their power. They gave us all the moral force that they could. They came and attended our meetings, and when the journeymen wanted to know what they were doing in New York, I said: 'You will find out in a little while it is a very bad general who will announce his plan of campaign before the battle takes place.' The president and traveling companions, I desire to say, rendered all the assistance they could; they met in our rooms and laid out the plan of campaign, to not hire any more men than they could throughout the country; to —"

The Chair (interrupting)—It is my wish, as the general referred to, that the plan of campaign be not given to the public. I think it would be altogether and highly improper to give away any of the plans. I don't think Mr. Young desires it.

A. Young—I desire to know if there is sufficient power in the President and Executive Committee to render such assistance as is desired in such an emergency.

President Allison—I would say no; we are not provided as we should be for meeting such a contingency.

A. Young—I move you that a committee of five be appointed to draft as a by-law a resolution covering just such an emergency.

Mr. Cochrane, New York—I second that.

Mr. Macdonald—I move as an amendment that the Executive Committee have full power to use all means and prerogatives possessed by this convention itself in an emergency like that in New York. I say to Mr. Young that we were helped by the visits paid us, and let us clothe them with still greater prerogatives for unusual occasions, making the Executive Committee really the National Association in adjourned session.

Rupert Coleman, Chicago—I think the relation of the national and local association should have more consideration than we have accorded to it. In case of strike, the issues underlying it may be of importance to the whole country, and clearly the local association should not be left to bear the burden alone, but contrariwise, should be upheld by every resource of the national body, or possibly enabled to make a graceful retreat from an erroneous position.

Mr. Dewstoe—It is most timely to devise some such way to throw to one point our concentrated force. For several years to come I think we have got to stand in a sort of attitude of armed neutrality until trades-unionism has run its little course of fever and died out.

Mr. McCoach said Mr. Young's motion involved a greater expenditure than the fixed and modest sum provided in the constitution and by-laws.

A. Young—In order to assist such distressed local associations, let the Executive Committee be empowered to raise any amount of funds by assessment or otherwise.

Mr. Gabay endorsed this.

Rupert Coleman then moved as an amendment to the constitution and by-laws—A. Young accepting the substitute—the following, and it was unanimously adopted:

"That it shall be the duty of the National President, in case of strikes, to call upon the association involved for a statement of the nature and cause of the strike. He shall then, at his discretion, proceed to the scene of action, or call for a meeting of the Executive Committee to take such action as may seem advisable and call upon the local associations for such aid as it may be possible to render."

Adjourned till 9 A. M. Thursday.

THIRD DAY.

The third day of the convention began with a report from the Executive Committee on their conference the

afternoon before with the committee of the metal workers, the gist of the statements being "they are heartily in accord with us in the interest of the plumber, and assured us they would abide by existing resolutions and would gladly attend, when called on, any meeting of the Executive Committee."

Financial Secretary Remick—"Two more 'counties' are heard from—Terre Haute, Ind., and Rockford, Ill., with Samuel N. Jones and William T. Pierrepont."

The next meeting place was then determined, the cities nominated being Boston, by Mr. Stevens, seconded by Mr. Boyd; New York, by Mr. Cochrane; Philadelphia, by P. Sanders; Washington, by Mr. Hannan. Several brief and breezy speeches were made, and Boston was unanimously selected; whereupon Mr. Stevens, for the Bostonians, expressed thanks, saying they would have the bean-pot boiling, and Mr. Dacey, as a professor at Harvard, invited all to inspect the plumbing of that institution.

Mr. Weaver moved that the incoming Executive Committee consider the feasibility of amending the constitution so as to admit Canadian plumbing associations. Mr. Gabay opposed this, and the motion was heavily defeated.

The election of officers being in order, the chair appointed Messrs. Ryan, Gabay, and Schulhafer as tellers.

For President, John Byrns, of New York, was put in nomination by ex-Alderman Ryan, of Chicago, who said: "We are about to lose the valuable services of our present president, as competent and capable a man as the craft has in the United States. To succeed him I nominate one who is worthy the confidence of the entire association; a man whose name has gone forth throughout the land as a mighty power in the plumbers' cause."

For the same office, Mr. Hannan, of Washington, nominated John Trainor, of Baltimore, as one who, in the position of First Vice-President, has done his entire duty, as also throughout his four years' continuous service in this body, and by merit and precedent has earned the highest promotion.

Mr. Sheehan, St. Louis, seconded Mr. Byrns as the standard bearer in the fight so gallantly waged for the past eight months in New York for the life of the association's principles there and throughout the country. [Applause.]

T. C. Boyd, Chicago, said that Trainor, as president, and Byrns, vice-president, would make a strong team. J. J. Wade, Chicago, wanted Trainor, an honorable representative plumber, and Robert Griffith, Chicago, wanted Byrns, a fighter and man of iron. The Baltimore candidate has not passed through the fire that the New Yorker has gone through unscathed. [Voice—Give him a chance!] No, sir! It is dangerous, with a battle raging give us the tried general [applause]. Mr. Rothrock, rising, said that while Byrns was a local hero, Trainor was equally a hero in Maryland, where something had been accomplished the past year as well as in New York. Trainor was mainly instrumental in securing a most important legislative victory; and while Byrns—at least till lately—was almost a stranger to the whole membership of the National Association, Trainor had been here at every convention, and an officer, doing his whole duty in every part. A. W. Murray, Chicago, in a short speech, eulogized Byrns as a proved match for trades-unionism, a despotism equal to anarchy. A Denver delegate, in a mirth-provoking harangue, wanted no Byrns in his.

The ballot gave Byrns 122 votes and Trainor 41.

Mr. Trainor—On the part of the gentlemen who were kind enough to present my name, I take great pleasure in moving that the vote for Mr. Byrns be made unanimous. Carried. Whereupon the new president was conducted to the platform by Sergeant-at-Arms Collins and Mr. Trainor, and, after a few words by the genial Allison, responded to the applause as follows:

Mr. Chairman and Gentlemen: I need hardly say how deeply and how much I appreciate the honor that you have just conferred upon me. If I had consulted my own feelings I should positively have declined, but I felt that this is a public trust that should not be sought for nor declined. I accept the distinguished honor which you have bestowed upon me, and I appreciate it the more from the fact that I did not solicit it, nor do I know of any one who solicited it on my behalf, for if I had known of such a thing I should have stopped it. I will attempt to perform the duties of the position to the best of my ability. In assuming the office, I have no friends to reward or enemies to punish. I have charity to all and desire to have malice toward none. I desire to be president of the whole organization throughout the country, not of any particular section or place. We have here one flag and one fold, and I will try to be as good a shepherd as I can. I am proud to preside over a meeting of this kind, a large, intelligent, respectable, honest body of men, who have assembled from all parts of our beloved country, coming here at a loss of time and money to themselves and their local organizations, that they might advance the interest of that trade and profession to which we have all devoted our lives. We have here a truly representative body. The Pilgrims of Boston are here; Divine Providence has sent us a Phillips; we have our friends from the Sunny South, and even the Quakers from Philadelphia are here. Gentlemen from the land of the Sierras are here, and even St. Paul is with us, I am prouder to preside here than I would be over any legislative body in this country and it would be well for the people of the various States if their legislatures were composed of a class of men so disinterested, so zealous and so honest as the men on the floor of this house. I am not vain enough to suppose for a moment that I am the only one who you have done me is a personal token that it is shown to the great city of New York which I represent her on the floor of this

question about that. I am not a hero, as some too partial gentlemen have said; I am simply acting a part with a band of heroes. My Chicago friend Hamblin marched with Sherman from Atlanta to the sea; I have marched from the ocean to the lake with a band of heroes and every man a veteran in the cause of honesty, truth, and right. I will not go into the details of our strike, the time being limited, and simply call your attention to one or two matters, and first that during this coming year we want no ornamental vice-presidents nor ornamental committees of any kind. Delegations will act accordingly and elect no man as a State Vice-President who is not willing to put on the harness and work from this henceforth. Every city in this country should be organized and every man should leave this hall determined for himself to solicit his neighbor, show him the great advantage of belonging to an organization of this kind. Establish your local organizations; show them the great power and the great strength of this organization. We must fight organization with organization, and you should go home to your various States and cities each man determined to perform his part in the great work that we have started out to accomplish. If you will do that, you will then advance the interest of the profession and advance yourselves. We are living in a time of progress and the valuable papers read here show that the plumber is advancing with the times. Let us then go from this hall, when we adjourn, to our homes, tell our brothers in the profession of what this convention was composed, invite them if they haven't already joined the local organizations, to do it, urge men in the profession in the adjoining cities throughout the States to form local organizations, so that when we meet at the Hub of the Universe we will have at least 250 representatives on the floor of Boston. I will not detain you any longer, gentlemen, but again thank you for the great honor you have done me, and on behalf of the New York delegation I return sincere thanks. [Much applause.]

John Trainor was unanimously elected Vice-President, and, when Sergeant-at-Arms Collins, with his "Brooklyn Bridge move," had landed him on the rostrum, said: "I owe you all a double debt of gratitude to-day, first for this honor that is to me most important; and also I thank you very kindly for not putting a greater responsibility on one so young in years and in association. I never sought the office I held last year. I will continue to do what I conceive to be for the very best interest of my home association and the National Association wherever it exists." [Applause.]

Mr. Weaver—I move that the President name the Secretary. Carried; and Mr. Byrns named H. G. Gabay, New York, who was confirmed as Recording Secretary; and later the President named Walter T. Hudson, Kings County, N. Y., Corresponding Secretary.

For Treasurer two nominations were made, M. J. Lyons, Brooklyn, the incumbent for 4 years, and J. J. Hamblin, Chicago. Mr. Finnerty, Boston, commended Mr. Lyons' faithful service, and also thought President Byrns should have all his cabinet close at hand. "I am requested," said a Chicago delegate, "by Mr. Hamblin, to withdraw his name in favor of Mr. Lyons;" and that gentleman was elected and thanked the house.

Enoch Remick, Philadelphia, was re-elected Financial Secretary, and D. J. Collins, St. Louis, Sergeant-at-Arms, Mr. Stevens, of Boston, saying he considered Collins specially created for that office, despite the silk flags lost at Deer Park. Collins, after some pleasant horse-play, assured the association he would find those flags if he had to invade Maryland and continue the walk to Boston.

For Auditing Committee the following were elected: William H. Rothrock, Baltimore; M. J. Duffy, Louisville; E. C. Cauvet, Minneapolis.

Enoch Remick brought up the question of *per capita* tax, and on motion of Mr. Sheehan it was left with the Executive Committee.

Martin Moylan moved an amendment to the constitution adding all ex-presidents to the Executive Committee.

Mr. McCoach thought the hour too late, and Mr. Weaver moved to refer it to the incoming Executive Committee to report at the next convention. Mr. Gabay thought the Executive Committee large enough. Mr. Weaver's motion carried.

J. J. Hamblin moved that all officers and National committeemen, whether delegated or not by local associations, should have all rights of the floor, including a vote.

Colonel Scott, New York, opposed the motion, as did Alderman McCoach and Treasurer Lyons. The matter was referred to the incoming Executive Committee to report after their first meeting to the local associations.

Thanks were voted to the local association, the press, and the public. Also, at the instance of their fair visitors, to the Chicago ladies and the Entertainment Committee.

State Vice-Presidents were selected by the different delegations as follows: Illinois, A. W. Murray, Chicago; Massachusetts, D. G. Finnerty, Boston; Nebraska, D. O. McEwen, Omaha; Maryland, D. W. Mitchell, Baltimore; Ohio, Richard Murphy, Cincinnati; Colorado, T. J. White, Denver; Michigan, John Cameron, Detroit; Indiana, James Madden (named by the President); New Jersey, Michael D. Moran, Jersey City; Missouri, Henry Goss, Kansas City; Kansas, John E. Ford, Newton; Kentucky, Simon Schulhafer, Louisville; Wisconsin, W. A. Goodman, Milwaukee; Minnesota, John Shea, St. Paul; Connecticut, Robert Morgan, New Haven; Virginia, W. E. Foster, Norfolk; Pennsylvania, James G. Weldon, Pittsburgh; California, J. L. Firman, San Francisco; Tennessee, J. L. Park, Nashville (named by the President); Rhode Island, William Whipple, Providence; District of Columbia, R. G. Campbell, Washington; New York, William Young, New York City.

Mr. Allison, in a neat farewell, surrendered the chair to his successor, and forthwith the Executive Committee was announced by President Byrns as follows: G. A. Scott, New York; E. J. Hannan, Washington; Jeremiah Sheehan, St. Louis; William Harkness, Philadelphia; Rupert Coleman, Chicago. Also the following committees: Apprenticeship—J. J. Weaver, Philadelphia; J. J. Donnegan, St. Paul; J. J. Hamblin, Chicago. Conference—William F. McCoach, Philadelphia; Isaac Riley, Boston; W. E. Goodwin, Milwaukee. Essays—Alexander W. Murray, Chicago; Martin Moylan, Chicago; T. C. Boyd, Chicago (declined, and P. Nacey, Chicago, substituted); J. J. Wade, Chicago; Robert Griffith, Chicago. Legislative—William F. McCarthy, Topeka, Kan.; Martin Moylan, Chicago; William T. Dunnett, Baltimore; J. A. Rossman, New York; S. J. Nolan, Cincinnati. Sanitary Committee—the State Vice-Presidents.

The convention stood adjourned.

NOTES.

Over the President's chair was a draping of flags with an eagle in the midst, and the motto: "Welcome—They builded better than they knew."

A Chicago paper described President Allison as looking more like a bank president than a plumber. It might have added that Byrns, of New York, and Campbell, of Washington, looked like United States Senators.

Thursday evening at the Grand Pacific Hotel, a reception and banquet were given the visiting plumbers and their wives by the Chicago association, and it was a handsome affair in itself and its appointments. There were four hundred covers, and the after-dinner speeches were in happy accord with the occasion. Among the speakers were Mayor Roche, Health Commissioner DeWolf, President Byrns, Ex-President Allison, Robert Griffith, Architect Adler, George C. Prussing.

It is hinted A. Young is the coming Grand Secretary.

The last day of the session Robert Sprout was present, representing Grand Rapids, Mich.

About a score of plumbers were accompanied by their wives, and a series of entertainments were given them by their fair hostesses. An interesting feature in which the ladies took the lead was the presentation at the Thursday evening reception of a marble clock to the retiring President and other rich mementoes to the retiring First Vice-President and Recording Secretary. Mrs. Shulhafer, of Louisville, and Mrs. Trainor, of Baltimore, chaperoned the diamond-begemmed committee. Apropos of the last clause, a blinded beholder whispered into a dainty seashell of an ear, "Her Majesty hasn't the only Kohinoor."

Wednesday at 4 P. M. the convention, almost in a body, visited the Manual Training School, at the closing exercises, and expressed themselves much pleased.

The Chicago Reception Committee began work early Sunday morning, when the St. Louis and Kansas City delegations arrived. Of the twenty-five Committeemen, the following seemed everywhere present: John Griffith, President of the Chicago Association; Jack Hamblin, James Roche, Joseph Clark, Alexander W. Murray, Wm. Sims, Michael Riley, Joseph Alcock, Frederick Neustadt, J. T. Wade, James McGinley, and Andrew Young, Chairman.

ANNUAL MEETING OF THE AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.

(By Our Special Correspondent.)

ST. PAUL, MINNESOTA, June 25.—The twentieth annual session of the American Railway Master Mechanics' Association was held in the Chamber of Commerce in this city during the past week. Hon. C. D. Kerr welcomed the association on behalf of St. Paul at the opening session Tuesday, and Thomas Cochrane, Jr., spoke in behalf of the Chamber of Commerce, extending also a hearty welcome. The annual address of President Johann was not long and quite general in its nature. He referred to the deaths of President William Woodcock, George Colby, W. W. Evans, H. G. Brooks and George E. Howe, members of the association. The convention adjourned for one-half hour out of respect to the memory of the deceased president, and resolutions of respect were adopted on his death, supplemented by eulogistic remarks by Messrs. J. N. Lauder, H. N. Sprague, Angus Sinclair, R. H. Briggs, President Johann, and Secretary Setchell. The subject of soft-coal using was then considered briefly, and a more interesting discussion followed brought out by the topic: "Is the Extension Front End Applied to Locomotives Economical?"

Secretary Setchell asked if it was not cheaper to clean out the accumulation of sparks and put them where they ought to be, than to have to be continually paying damages for forest fires.

J. N. Lauder said that for three years the Old Colony road had been using the extension front and smoke arch exclusively, and was now putting them on the engines. Smoke was another nuisance from the diamond stacks. He had met with considerable difficulty in getting a proper draft, so, instead of bringing the exhaust-pipes out of the bed-plate in the centre, he brought them out where the lead pipes usually go in, thus leaving a chance for a free draft for the flues directly in front of the smoke-arch. Since using the extension front the danger from fires had almost entirely disappeared.

John Hickey said that he was using the extension front on his road and found it saved fuel, sparks, and smoke. He advocated a tight front end.

John McKenzie did not believe in the extension front. He gave as reasons that they weighed about 5,000 pounds

each, and that such a dead weight on the front end was not practicable; that there was less danger from a properly constructed stack and arch than from the extension front, and that there was need of extra help to clean out the front, which needed cleaning twice in every run of about 140 miles.

Mr. H. L. Cooper thought the properly constructed arch the correct thing. If there was any extension front to be added to an engine it ought to be on the drivers.

Mr. H. A. Town thought a committee should be appointed to investigate the matter, and expressed the opinion that in the past the committees appointed by the association had not paid the attention to the matters given them to investigate which they should have done.

E. M. Roberts favored the extension front. He thought an improvement needed was something to catch small cinders. He used a 13-mesh with three wires, but had some difficulty. He corrected Mr. McKenzie on the weight of the front, claiming that it only weighed from 1,000 to 1,500 pounds instead of 5,000.

R. H. Briggs said some people built an engine as they would a house, with fancy points and with no reference to utility. He held that uniformity in construction would produce the best results.

James Meehan said that the average consumption of fuel on the Cincinnati Southern for 1881 was 91 pounds per mile, with \$33,000 paid for fire damages; while last year, with the extension fronts, the average was only 62 pounds per mile, and not a dollar paid out for fire losses.

The second day's session began with a report from Secretary Setchell, showing that during the year 29 new members had been added, 5 had died, 5 resigned, 13 had been dropped, 4 had become honorary members, leaving 251 full members, 41 associate members, 14 honorary members—a grand total of 279. The treasurer's report showed expenditures during the year of \$1,934.54; balance on hand, \$497.22.

Messrs. Charles Blackwell, F. L. Wanklyn, and T. E. Bennett presented a report on the "Proportion of Locomotive Cylinders," which was accepted and ordered printed.

"Traction Increases—Their Types and Relative Merit; also Causes in which their Use can be Recommended," was the next topic discussed.

Messrs. Briggs and McKenzie stated that they had fitted up an engine with a traction increaser that would use one box of sand a week, while the ordinary sand-box had to be filled two or three times each trip. Secretary Setchell was in favor of an increaser. Mr. Lauder thought an increaser might be well in theory, but not in practice.

The committee on "Crossheads and Guide-Bars—The Various Types in Use, Materials, Construction, and Results Obtained," were not prepared to report and were continued another year.

The report of the committee on "Steam Packing" was presented by Messrs. J. W. Stokes, Allen Cook, Henry Schlocks. Under the head of special subjects H. N. Buford wanted to know the average number of miles a locomotive ought to run on a pint of cylinder oil. He considered 75 miles enough, but had heard men talk of 175. Secretary Setchell thought 75 miles a fair average. Mr. McKenzie stated that his passenger locomotives ran 116 miles on a pint of oil, and one engineer had run 232 miles. T. J. Hatswell said that on a test he had thus run an engine 360 miles. President Johann stated that he had found the least expense in running an engine had not always been the most economical.

"Increased Boiler Pressure" was the subject of an extended discussion.

Mr. Lauder said it was no use to attempt to start out with low pressure to compound the steam. It was not economy to cut off the steam in a 24-inch stroke to six inches. He had used 175 pounds pressure with decidedly good results. The great question was, How to get more power without increasing the weight. Large cylinders must not be used, however, as there was trouble to get the steam. With the right kind of a boiler he did not think it would be unsafe to carry 200 pounds of steam with a locomotive to maintain it.

Mr. Howison thought 200 pounds could be safely carried, but the steam would be saturated and not superheated. He thought it would not be long before fast passenger engines would be carrying from 225 to 250 pounds to the square inch.

Mr. Hickey held that the amount of the pressure would depend upon the strength of the boiler and the adhesion to hold it. If more power was needed, increase the size of the boiler. Superheated steam would make it difficult to lubricate the cylinders.

Mr. Ames offered a resolution to the effect that it was not advisable to raise the boiler pressure above 135 pounds per square inch on the freight service.

The third day's session began with a paper on "Coaling up Locomotives, The Various Plans in Use and Their Relative Cost and Efficiency," presented by J. P. Barnett, James Strode, and Charles Graham. The paper was accepted as the report of the committee.

G. Ettenger, W. H. Thomas, and T. W. Gentry reported on "Locomotive Preparation." This report concluded as follows:

"Your committee conclude that with boilers that are constructed with reference to being easily accessible to all their interior parts, the best system for washing out is by means of a high-service storage tank in connection with a stationary boiler and proper piping for blower and blow-cock connections and the steam-boiler wash-out of which there are several good ones on the road. The live engine is to contribute its steam to the wash-out tank,

and in return, when washed, to receive its fill of hot water from that source."

Mr. Ettenger read a letter from an electrician, holding that locomotive fires could be more cheaply started by electricity.

Mr. Lauder presented a scientific report of a test made at the Watertown, Mass., arsenal on sections of three and four-inch tires, showing that there was no difference in density considered from a scientific standpoint. Reports were made on "Standard Form of Tire Section" and "What Control has the Engineer over the Driving Wheel?"

The officers for the ensuing year were elected as follows: President, J. H. Setchell, Dunkirk, N. Y.; Vice-Presidents, R. H. Briggs, Argentine, Kan., John McKenzie, Cleveland, Ohio; Secretary, Angus Sinclair, Chicago; Treasurer, George Richards, Boston, Mass.

E. D. Anderson, of Vicksburg, Va., was elected to the subject committee to serve three years, vice T. B. Twombly, of Chicago, whose term had expired. It was decided to meet next year at Alexandria Bay.

The topics decided upon for discussion at the next annual convention are as follows:

1. Relative proportions of cylinders and driving wheels to boilers.
2. Guides.
3. Extension smoke-boxes and brick and other fire-box arches.
4. Spring and equalizing gear.
5. Tires—advantage or otherwise of using thick tires.
6. Purification or softening of water before being delivered to locomotive-tenders.
7. Prevention of dangerous escape of fire coals and sparks from ash-pans.
8. Tender-trucks.
9. Traction increasers, in connection with over-cylindered engines.

MOVING OF A RAILROAD BRIDGE.

In the improvements on the Pennsylvania road, it became necessary to move an iron bridge weighing 160 tons, 50 feet sidewise.

The feat was successfully accomplished by the use of a temporary trestling supporting four lines of iron rails, and four compound and four single-gear crabs. The rails were thoroughly greased. The arrangements were all carefully tested, and the time occupied after movement began was 11 1/4 minutes. Thirty-two men supplied the power, and the connections were made and trains running in half an hour.

PERSONAL.

JAMES S. MCENTEE, civil engineer, died June 30, at Rondout, N. Y.

THE convention of the American Institute of Mining Engineers will begin at Duluth, July 26.

CHIEF ENGINEER HENRY LEE SNYDER, U. S. N., Superintendent of the State, War, and Navy Departments Building in Washington, died June 30 in the 50th year of his age.

A. A. TALMAGE, General Manager of the Wabash, St. Louis, and Pacific Railway, died June 28 in the 54th year of his age.

GOVERNOR HILL has approved the bill providing for the modified commission on subways for electric wires in New York City.

ARCHITECTURAL COMPETITIONS.

EVANSVILLE, IND.—The competition for the plans for the new court-house, to be erected here, was decided, June 25, in favor of H. J. Walters, of Louisville, for first premium of \$500; W. H. Decker, formerly of Cincinnati, now of Philadelphia, for second premium of \$300; H. B. Wheelock, of Chicago, and F. J. Schlatter, of Evansville, for third premium of \$200. There were eleven competitors submitting designs. Among them were S. Hannaford, of Cincinnati; McDonald Bros. of Louisville; Cochran & McKean, of Chicago; Bunting, of Indianapolis; Clark & Saur, of Evansville. The new building will cost a half million dollars complete.

THE Board of Public Works of Milwaukee ask for plans and specifications for a school building, not to cost more than \$30,000 complete. The competition will close August 1.

The board also wants plans, until July 18, for a \$25,000 school building; also, until July 18, plans for a \$30,000 school building.

ENGINEERING COMPETITION.

Colonel J. M. Wilson, Lieutenant Colonel Peter C. Hains, and Major G. J. Lydecker, a Board of Engineer Officers, who have been considering the subject of a bridge across the foot of Pennsylvania Avenue, have made a report to the Secretary of War approving Lieutenant-Colonel Hains' report to the Chief of Engineers on the bridge question, and recommending that plans and prices on a bridge shall be advertised for.

NEWARK, N. J.—The discussion over the success or failure of the new sewerage system has led to a division by Council, at request of the engineer, Mr. Schaeffer, to appoint a committee of expert civil engineers to pass upon the work.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



Persons who make any use of the information they find in these columns will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 117-119-120.

WATER, SEWERAGE, ETC.

WATER COMPANY.—Articles of incorporation were filed June 14 by the Pacific Water Company. The purpose is to acquire water and water-rights, and sell the same, in the San Gabriel Valley, Cal. The directors are: H. H. Markham, L. W. Dennis, Nelson Vanderslip, and C. H. Bradley.

SAN DIEGO, CAL.—E. A. Beardsley, J. M. Logsdon, E. W. Fairchild, and C. W. McMaster have purchased the controlling interest in the Mokelumne Ditch and Irrigation Company in Calaveras County. The object of the company is to utilize the Mokelumne River for irrigating San Joaquin County by means of canals and ditches from the dam at Westmoreland's bridge, and about 300,000 acres will be covered. Immediate action will be taken.

BUFFALO, N. Y., wants a 20,000,000-gallon pumping engine. See proposal column.

COUNCIL BLUFFS, IOWA.—The water-works will lay about four miles of pipe this year.

JANESVILLE, WIS., is agitating for a system of sewers.

ALLENTOWN, PA.—The Board of Water Commissioners will visit New York, Brooklyn, Fall River and other cities, before acting on the bids recently submitted for pumping machinery.

SEWERS.—Governor Hill has signed the bill providing for the Gravesend sewer.

TAUNTON, MASS.—The Water Commissioners will sink wells at the pumping station, to secure a more abundant supply of water.

NASHVILLE, TENN.—The Water-Works Company asks for proposals for building a reservoir. The estimated cost is \$434,000.

PASADENA, CAL.—The City Council has appointed an election, to vote upon the raising of \$192,000 of bonds for sewers and fire protection.

BURNET, TEX.—It is the intention of the city to erect water-works. Address A. R. Johnson.

WICKFORD, R. I.—The Water Company will build works.

WAKEFIELD, R. I.—The Water Company will build works.

WORCESTER, MASS.—The superintendent of Sewers will arch Mill Brook sewer, at a cost of \$22,000.

MEMPHIS, TENN.—Mr. W. L. Cameron, Secretary of the Water Works Company, has closed a contract for a Worthington steam-pump and connections for \$25,000, and two miles of 36-inch pipe, with Dennis Long & Co., of Louisville.

JANESVILLE, WIS.—The contract for laying the water-pipe has been awarded to Carroll E. Gray, of Chicago, for the stand-pipe to Tippetts & Wood, of Phillipsburg, N. J. The stand-pipe will be 25 by 85 feet. J. F. Williams is engineer in charge.

SILVERTON, COL., will buy the water-works.

SYRACUSE, N. Y. Common Council, on June 27, granted a franchise to the Salmon River and Onondaga Water Company, which proposes to build water-works, costing \$4,000,000.

SUMTER, S. C.—The contract recently made with Northern parties for constructing water-works has fallen through. New proposals will at once be advertised for.

WALLA WALLA.—The Water-Works Company will let contracts for building the works.

WATER-WORKS.—The following cities and towns are discussing water-works: Waldo, Me.; Benton Harbor, Mich.; Skaneateles, N. Y.; Colorado City, Col.; Butler, Mo.

NEWPORT, ARK., has accepted the water-works just finished, and will take 55 hydrants and plugs at a rental of \$2,500 yearly.

FERNANDINA, FLA., wants a system of water-works.

JOLIET, ILL.—Our correspondent writes: "There is a system of water-works in this city owned and managed by a private corporation. They contemplate rebuilding and making changes in said works. Information can be obtained by addressing the Secretary of the Joliet Water-Works Co."

MOORESTOWN, N. J.—The Water Company has organized, and elected the following officers: President, Dr. N. Newlin Stokes; Vice-President, J. E. Watkins; Treasurer, James C. Hopkins; Secretary, Samuel K. Robbins, Esq. Directors, Harry W. Doughten, W. N. Bannard, C. S. Sims, and the officers.

MACON, GEO.—There is talk of organizing a new water company. A contract has been made with the existing company to furnish 150 hydrants at \$50 each annually.

VAN BUREN, ARK.—The city has contracted for water-works.

LEWISTON, ILL., will have water-works.

WATER-WORKS are proposed for Herington, Kan.

BIRD CITY, KAN., will build water-works.

GLENWOOD, COL.—The town has accepted the proposition of S. J. de Lan to build water-works and furnish water. The town is to take 75 hydrants at \$50 per annum, payable quarterly, and \$30 annually for each additional hydrant. The source of supply will be either mountain springs or wells.

WARREN, MASS.—The residents of Beacon Street propose to build a reservoir on Fairbanks Hill, at the head of the street, and bring water to all the houses on the street.

MILWAUKEE, WIS.—A large brick sewer will be built in Fourth Avenue, from Washington Street to the intersecting sewer.

GLOVERSVILLE, N. Y.—The town has decided to spend \$5,000 on the construction of new sewers. The vote by which this was decided on empowers the corporation to expend \$15,000 upon the entire work.

ALTOONA, PA.—The city proposes to finish the Kittingan Point Reservoir and lay a 16-inch iron main to the city.

RED CLOUD, NEB.—Address H. Pond, City Clerk, about proposals for water-works here.

SANDFORD, FLA.—S. McLain has the contract for constructing works for the Water-Works Company.

CATONSVILLE, MD.—Mr. Joseph Cone has completed wells for water-supply and mains will be laid.

CHIFFEWA FALLS, MINN.—The Chicago, Milwaukee and St. Paul Railroad Company is building a dam on the Wisconsin River at a cost of \$200,000. The pond so formed will cover 11,000 acres.

MANCHESTER, TENN.—A correspondent writes: "There have been no steps taken as regards water-works at this place as yet, although they have been somewhat talked of."

PORTLAND, ME.—The Diamond Island Water Company, of Portland, has been incorporated; capital stock, \$5,000. Franklin M. Lawrence, incorporator.

BOSTON.—The Aldermanic Committee on Water reports favoring a connection with the water-system of Charleston, under appropriation of \$115,000 to meet the expense.

AMERICUS, GEO.—Ellis and Slocum, of Montgomery, Ala., are contractors for water-works here.

ALBANY, N. Y.—Surveys are in progress for the Martinville sewer. It will cost \$100,000.

LOS ANGELES, CAL.—The Sewer Committee wants to build a lot of pipe sewers. The City Engineer will advertise for pipe.

GRAND RAPIDS.—The specification for water-works at the Soldiers' Home have been completed, and bids will be asked for.

SANTA ROSA, CAL., wants a better water-supply.

OAKLAND, CAL., is considering the question of filtering its water-supply. Address the Contra Costa Water Company.

HELENA, MONT.—George F. Woodston will begin work at once on the water-works.

MERIDIAN, MISS.—The city authorities accepted June 23 the water-works as tendered by the Meridian Water-Works Company.

CHICAGO Aldermen are now deliberating on the proposed water-works tunnel, favored by Engineer Artingstall and the Mayor.

ALBANY, N. Y.—The Water Commission has entered into a contract with Andrews Bros., to furnish water from driven-wells. The contractor agrees that in the test which is to be continued for one year after completion of the work, the yield shall be 10,000,000 gallons daily. If the quantity falls below this the commission may reject the plant or accept at a price less than the contract price proportional to the diminished quantity of water. If the test for quality fails, the commission shall reject the plant. The price is \$237,500.

HAMILTON, ONT.—The Sewer Committee asks for \$10,000 for new sewers.

WALLA WALLA, WASH. T.—The city is discussing a sewerage system.

OMAHA, NEB. (Special). Water-Works Company will expend \$800,000 on extensions this year.

NEBRASKA CITY, NEB. (Special). is having grade and sewerage plans prepared by Rosewater, Christie & Lowe, of Omaha.

SEYMOUR PARK, NEB. (Special).—This place is having plans for sewers made by Rosewater, Christie & Lowe, of Omaha. Water-works and electric lighting will also be introduced.

ELMIRA, N. Y.—The special election held June 27 on the question of bonding the city for sewers resulted in a negative. The total number of votes cast was 909, of which 113 were for the proposed measure and 796 were against it.

LOWELL, MASS.—Both branches of City Council have authorized the borrowing of \$50,000 for the construction of sewers.

AUSTIN, MINN.—The town has voted water-works, embracing a system of wells for drinking purposes and river connection for fires. Estimated cost from \$25,000 to \$40,000.

WICHITA, KAN. (Special).—A sewerage system is being designed by Rosewater, Christie & Lowe, of Omaha, Neb.

BEATRICE, NEB. (Special).—Rosewater, Christie & Lowe have made grade plans and sewerage plans for this place.

PLATTSBROUGH, NEB. (Special).—Grade and sewerage plans are being designed by Rosewater, Christie & Lowe, of Omaha, Neb.

LEBANON, PA.—Mr. Harvey Tyron, a civil engineer, of Reading, Pa., has been employed to superintend the construction of a water-plant at McLaughlin's Dam.

RIVERSIDE, CAL.—The Riverside Improvement Company on June 14 awarded the contract for the construction of the Riverside water-mains and lateral piping over the Roubidoux tract to Lacy & Hooker, of Los Angeles at \$100,000.

The bids opened by the city trustees for lateral sewers in Sewer District No. 1, were all rejected. New bids were advertised for.

GAS, STEAM, BUILDINGS, ETC.

BIRMINGHAM, ALA.—A company of Philadelphians will sink gas-wells and establish works.

PORT HURON, MICH.—The St. Clair Light and Fuel Company, of this place, will sink gas wells at once.

SAN FRANCISCO, CAL.—The Natural Gas and Development Company has filed articles of incorporation. The directors for the first year are: J. B. Southard, F. W. Bean, David McClure, Philip I. Weaver, James Lawler, and A. Pierce, of San Francisco, and John P. Jones, of Gold Hill, Nevada.

TOLEDO, O.—The Lucas County Natural Gas and Oil Company is incorporated.

TOLEDO, O.—Our correspondent writes: "The contest over the proposed schedule of natural gas, as filed by the Toledo Natural Gas Company, and another and much lower one, offered in the City Council, has come to an end by the whole matter being tabled by the Council. It is thought that both the gas companies, which have extensive systems of pipes throughout the city, can now go on with their (experimental) service without further interruption. It is claimed that the charges for manufacturing and ordinary heating purposes are lower than the average of towns and cities where pipe lines have been introduced."

GREENSBURG, PA.—Wilson McCandles, President of the Allegheny National Bank, and others, have formed a company to sink wells, etc., in the Murraysville gas belt.

GAS COMPANIES.—Incorporated are the Kanabakee, Ill. Natural Gas Company; David H. Paddock and others incorporators.

The Peabody, Kan., Gas and Electric-Light Company; Thomas Osborne and others incorporators.

The Arkansas City, Kan., Natural Gas and Coal Company; A. G. Lowe and others incorporators.

The Hector Oil and Natural Gas Company, Monroe, Mich.; H. Saunders and others incorporators.

WEST TROY, N. Y.—The village president will enter into a contract with the West Troy Gas-Light Company to light the village for the ensuing year.

CAMDEN, N. J.—The Camden Gas Light Company has been awarded the contract for the ensuing year for the lighting of the public lamps at \$25 per lamp, and the Wheeler Reflector Light Company, of New York, has received the contract for the oil-lamps at \$20 each.

DENVER, COL.—J. J. Thomas & Co. will sink natural-gas wells near this city.

INDEPENDENCE, KAN.—A fund has been raised by the city to prospect for natural-gas.

EMPORIA, KAN.—The Gas, Oil, and Mining Company will sink gas-wells at once. Address I. E. Perley.

CINCINNATI, O.—The North Side Natural-Gas and Oil Company (Albert Williamson, President) is asking the city for a franchise permitting the company to open the streets, lay mains, and furnish natural-gas.

BROOKLYN.—President Quintard, of the Kings County Board of Supervisors, has vetoed the award of contract to P. J. Carlin for constructing the buildings at St. Johnland County Farm. Following this, on June 29, the Commissioner of Charities and Correction adopted a resolution withdrawing the plans from the Board of Supervisors, in accordance of which the plans have been returned and the contract is off.

SYRACUSE, N. Y. Common Council has authorized the Mayor to make a three years' contract with the Syracuse Electric-Light Company to furnish 147 additional lights at \$12 per month each. The lamp is Thomson-Houston make.

SAN FRANCISCO, CAL.—The Rae Electric-System Company have filed articles of incorporation in the County Clerk's office. Julius Jacobs, A. P. Brayton, Julio Rae, George C. Perkins, and William Alvord are the directors, representing \$1,000,000 capital stock, all of which is subscribed.

MARINETTE, WIS.—A gas company is applying for a franchise.

NEWPORT, O.—George W. Wilshire has applied for authority to lay pipes and furnish natural-gas for fuel.

CAMDEN, N. J.—The Philadelphia Lightning Company have filed articles at Camden of incorporation, with an authorized capital of \$3,000,000.

NEWPORT, O.—Judge McKibben has applied to City Council for a franchise permitting a company to erect poles and furnish electric-lighting.

MACON, GEO.—A new gas company is organizing here.

DETROIT, MICH.—The Board of Aldermen has voted in favor of making a contract with the Brush Electric-Light Company for lighting the streets for three years, at \$124,500 per annum, and \$100 per annum for each extra light.

MARION, IND.—Leonard Best & Co., of Buffalo, N. Y., have bought the Luma gas well at Fairmont, and will lay gas-mains to supply neighboring towns.

CIRCLEVILLE, O.—The Citizens' Natural-Gas and Mineral Company of this place is incorporated.

TOLEDO, O.—Two more natural-gas companies are applying for authority to lay mains and furnish the gas. They are the Black Swamp Natural-Gas and Oil Company and the Ohio Natural-Gas and Oil Company. The incorporators of the former are S. C. Schenck, D. Coghlin, G. M. Acklin, J. F. Kumler, and E. S. Dodd, and of the latter, H. S. Walbridge, D. Coghlin, S. C. Reynolds, A. L. Backus, W. Peter, C. F. Curtis, and J. K. Secor.

SPRINGFIELD, ILL.—Incorporated is the Galesburg Improvement Company, to prospect for natural gas, etc.

LYNN, IND.—Natural-gas wells will be sunk at once.

RAILROADS, BRIDGES, CANALS.

BRIDGE.—Governor Hill has signed the bill extending the time of completion of the Hudson River bridge at Poughkeepsie from January 1, 1888, to January 1, 1889.

MARINETTE, WIS. City Council has decided to build a bridge over the Menomonee River.

LOS ANGELES, CAL.—A viaduct for the railway tracks will be built.

LOS ANGELES, CAL.—The Mateo Street and Santa Fe Avenue Street Car Company has been incorporated. The object is to construct and operate a street-car line. The directors are: A. C. Hiscok, Charles A. Smith, H. M. Ames, S. D. Northcutt, J. O. Lotspeich, S. P. Rees, and M. L. Wicks. Capital stock, \$12,000; all subscribed.

RIVERSIDE, CAL.—The Riverside and Arlington Electric Railway Company has been incorporated at Riverside, with a capital stock of \$500,000, to build twelve and one-half miles of road in one line, and additional branches as they are needed. The Board of Directors chosen are Matthew Gage, S. C. Evans, James Bettner, A. S. White, Thomas Bakewell, W. J. J. Jarvis, and G. O. Newman.

SEATTLE, WASH. TER.—The Seattle Cable Road and Water Company has been incorporated by J. K. Murphy, C. P. Dam, and C. Coppin; capital stock, \$150,000.

LOS ANGELES, CAL.—The Alhambra and Ramona Street Railway Company has been incorporated at Los Angeles by A. Phillips, A. C. Weeks, J. De Barth Shorb, E. L. Watkins, H. W. Stanton; capital stock, \$100,000.

ALBANY, N. Y.—The New York, Chicago, and St. Louis Railway, to run from Buffalo to the Chautauqua border, a distance of seventy miles, has been incorporated, with \$4,500,000 capital. William K. Vanderbilt is a stockholder.

FORT PLAIN, N. Y.—The Fort Plain and Richfield Springs Railroad line is being surveyed.

PALATKA, FLA.—The St. Johns and Halifax, and St. Augustine and Palatka Railway managers, together with those of the J. T. & K. W., have decided to bridge the river at Palatka. Major McGlaughlin and President White were in the city June 23, when this was decided upon.

WINNIPEG.—Address Premier John Norquay about the extension of the railroad from the Northern Pacific to Winnipeg.

MACON, GEO.—The Macon Construction Company (W. B. Sparks, President, J. Lane, General Manager), has awarded the contracts for the construction of the Georgia Southern and Florida Railroad as follows: Grading to T. J. James & Bros., of Atlanta; cross-ties and trestling to Pitman, Baker & Co., of Thomasville. Prices are not made public.

DAVENPORT, IOWA.—The Bridge, Second Street and Northwestern Street Railway Company want bids for constructing and equipping the road. Address P. W. McManus.

CHICAGO.—Incorporated is the Equitable Transportation Company to build an elevated railroad from Blue Island to Chicago; William Cook, James Thompson, and Joseph Coolidge, incorporators.

SIOUX CITY, IOWA.—The Sioux City and Morning Side Railway Company is incorporated to build steel railways; William L. Joy, E. C. Peters, Edward Hankinson, J. O. Patterson and F. Pershing, incorporators.

PASADENA, CAL.—Mr. Yokum constructs about ten miles of railroad. The line will partially be operated by horse-power. A part will be cable-road, and the largest part will be a narrow-gauge steam railroad. A bridge of two large spans (deck) and several bents of trestle-work spans the Arroyo Seco, on a heavy grade, and at a height of sixty-five feet. The trusses are Pratt combination, fifteen feet apart and nearly thirty feet high. A corporation has been formed here, of which Col. Markham, Mr. Williams, Mr. Martin are members, to construct a rack railroad to Wilson's Peak, the highest point of the Sierra Madre Mountains, sheltering Pasadena towards the north. The road will be about five miles in length, traverse very rough country, and winds up to a height of 7,000 feet above sea. The Altadena Railroad, a standard gauge steam railroad (real estate enterprise), will lead to the foot of the hills, about seven miles off Pasadena, and join the mountain railroad. A capital of \$500,000 has been provided for. The Peak will be adorned with a hotel, and an astronomical observatory (perhaps), for which Mr. Spence, of Los Angeles, has donated \$50,000 to begin the subscription.

RAILROAD.—The Atchison, Topeka and Santa Fe Railway Engineers have been surveying over the line of the St. Louis and Chicago Railway from Peoria to Springfield and Litchfield, Ill.

SIOUX FALLS, DAK.—The Duluth line of the Manitoba Railroad will be extended to this place.

PATERSON, N. J.—The Street Committee has decided upon the streets on which \$30,000 shall be expended for macadam pavement.

FRAMINGHAM, MASS.—A Street Railroad Company has been formed here to build seven miles of railroad; capital, \$60,000.

BIG RAPIDS, MICH., has voted to spend \$15,000 on an iron bridge.

BLOCK ISLAND, R. I.—No bids were received for cutting a channel from Salt Pond to the Ocean. New specifications have been prepared by Town Council, and bids will be received until July 5.

ST. JOSEPH, MICH.—On July 2 the town will vote on the question of raising \$15,000 for an iron bridge across the river.

DOUGHERTY COUNTY, GEO., has voted to raise \$20,000 to pay for a bridge.

RAILROAD.—A company has been chartered with a capital stock of \$1,000,000 to build an elevated railway from Blue Island to Chicago.

SAULT STE. MARIE will have a street railway.

RAILROAD.—An organization has been made under a charter granted by the Kentucky Legislature three years ago, incorporating the Louisville, Cincinnati and Virginia Railroad Company. The line of the proposed road starts from Winchester, Ky., where it connects with the Kentucky Central and Elizabethtown, Lexington and Big Sandy Roads, proceeds to the Three Forks of the Kentucky River and thence passes through the coal fields of south-eastern Kentucky to a point on the Virginia line, where it connects with the Norfolk and Western Railroad. Among the directors are Messrs. Douglas Green, J. L. Robertson, and F. K. Hain, of New York City; ex-Senator J. S. Williams, A. W. Hamilton, and T. G. Stuart, of Kentucky, and W. D. Hill and C. T. Hunt, of Birmingham, Ala.

WASHINGTON, D. C.—The report of the Board of Engineer Officers, consisting of Colonel J. M. Wilson, Lieut.-Col. P. C. Hains, and Major G. J. Lydecker, appointed to consider the subject of the construction of a bridge across Eastern Branch, at the foot of Pennsylvania Avenue, was laid before the Secretary of War, June 22. The location of the proposed bridge recommended by Lieut.-Col. Hains, in his report to the Chief of Engineers, May 31, 1887, is approved by the board. The bridge will be 1,705 feet long between high-water lines, with approaches about 530 feet long, making the total length of bridge and approaches about 2,235 feet. The board recommends that advertisement for plans and prices of a bridge that shall conform to the general requirements indicated above be now prepared and published, as required by the act approved February 23, 1887.

ROXBURY, KAN.—The Gypsum Valley Railroad Company is incorporated by Jarvis P. Tolles and others.

ATTICA, KAN.—The Newtown, Alton and El Paso Railroad is incorporated; W. E. Campbell and others.

PONTIAC, ILL.—Incorporated is the Pontiac Street Railroad Company; Peason M. George, incorporator.

MACON, GEO.—Pittman & Baker, of Thomasville, have contracted to build bridges and trestles, and furnish cross-ties for the Georgia Southern and Florida Railroad.

RAILROAD.—The Clay Centre, Minneapolis, Kanopolis and Western Railroad Company, Minneapolis, Minn.; John Triplett and others, incorporators.

MILWAUKEE, WIS.—City Engineer Benzenberg has submitted plans and specifications for a viaduct across the Menomonee Valley in line with Eleventh Avenue and Sixteenth Street, from Pierce Street in the Eighth Ward to Clybourn Street in the Sixth Ward. The plans contemplate an approach on each side retained by stone abutments of 144-foot iron drawspans, and of 3,735 feet of iron trestle bridge on stone piers, resting upon pile foundations. The spans vary from 30 to 45 feet, and consist of heavy plate girders. The roadway is to be not less than 37 feet above city datum, 30 feet wide, and laid with cedar block pavement, with asphalt-cement filling. The sidewalks are to be 9 feet wide in the clear. The estimated cost, including right of way across the valley is estimated at \$495,700.

MINNEAPOLIS, MINN.—The Belt Line and Transfer Company has been incorporated to construct terminal lines in St. Paul and Minneapolis by W. D. Washburn, C. J. Blethen, and others.

PITTSBURG, PA.—The Pittsburg and Western Railroad will make extensions of its line, building about 110 miles of new track.

TOPEKA, KAN.—The City Clerk has been directed to advertise for proposals for paving certain streets with asphalt.

PITTSBURG, PA.—A company is being organized in this city for the purpose of selling rights for electric railway purposes. It is to be called the Overhead Conductor Electric Railway Company, and has a capital stock of \$400,000. Among those interested in it are George Westinghouse, Jr., John Caldwell, H. H. Westinghouse, Frank L. Pope, and Thomas B. Kerr.

RAILROAD.—The Springfield, O., and Western Railroad Company has been incorporated at Columbus, O.; capital, \$500,000.

OMAHA, NEB.—The Metropolitan Cable Road will be begun at once. R. Gilman is Consulting Engineer.

COOPERSTOWN, N. Y.—Articles of incorporation of the Mohawk and Susquehanna Valley Railway Co. were filed with the Secretary of State June 29. This is the long-talked-of scheme. The length of the proposed road is forty-five miles. It will run through or into the counties of Montgomery, Herkimer, and Otsego. The directors are: Sidney Dillon, George Foster Peabody, Arthur W. Soper, Edward M. Bulkley, J. D. Davidson, W. A. Barbour, W. R. Thomas, J. B. Skehan, Joseph Williams, and A. P. D. Hender, New York City; Edwin Packard, Brooklyn; W. J. Arkell, Canajoharie, and J. K. Hitchcock, Orange, N. J.

ERIE, PA.—The Barber Paving Company has estimated the cost of paving West Fifth Street at \$11,000. The work will be done.

ST. JOSEPH, MO.—The Wyatt Park Railway Company of this city is incorporated to build a cable-road.

SANTA FE, N. M.—The New Mexico Central Railroad Company was organized June 23, with Judge Henry L. Waldo, of Santa Fe, President, W. H. Rosington, of Topeka, Vice-President, F. W. Wilder, of Topeka, Secretary and Treasurer, W. W. Griffin, of Santa Fe, Assistant Secretary, C. L. Goodwin, of Boston, Assistant Treasurer, A. A. Robinson, of Topeka, Chief-Engineer, and J. P. Whitehead, of Boston, Comptroller and General Auditor.

The Rio Grande Land Company was also organized with W. H. Waldo, President, A. H. Johnson, of Topeka, Vice-President, E. W. Wilder, Secretary and Treasurer, W. H. Griffin, Assistant Secretary, and J. K. Livingston, of Santa Fe, General Agent. The company was formed to assist in developing New Mexico, particularly the Rio Grande Valley. The headquarters are at Santa Fe.

BIDS OPENED.

MILWAUKEE, WIS.—R. J. Finn secured the contract for laying house drains on Mitchell Street at 60c. per lineal foot, and will receive \$1.09 per lineal foot for laying water-mains on the short side and 67c. per lineal foot for the short side. The sewers are generally in the centre of the street and the water-pipes on the east and north sides of the street.

STILLWATER, MINN.—Bids for a 30-cell solitary were opened June 20 by H. G. Stordock, Warden, and the contract was awarded to F. H. Lemon & Co., of Stillwater, at \$19,856.

MILWAUKEE, WIS.—The contracts for the new St. Rosa's Orphan Asylum were let by the architects, E. T. Mix & Co., June 22, as follows: Mason work, Charles Kraatz; carpenter work, Ellis & Coogan; cut stone, J. L. Cox; painting, Robert Harper & Sons. The cost of the building will be about \$40,000.

DE PEPE, WIS.—The Street Committee on June 16 opened the bids for furnishing the city with sewer-pipe. The contract was awarded to P. S. Loy at 56½ per cent. off union prices. Winegard & Persons Co.'s bid was 55 and a Milwaukee firm's 53 per cent. off.

MEMPHIS, TENN.—J. A. Bailey & Co. have the contract at \$4,000 for plumbing of the new Lowenstein building, costing nearly \$200,000.

YOUNGSTOWN, O.—On June 22 the City Clerk opened bids for furnishing and laying 13,000 square yards of vitrified fire clay pavement: Evan J. Davis and David Gore, of Youngstown, bid on excavation, 45c. per cubic yard, total, \$3,084.75; on agricultural tile, 4c. per lineal foot, total, \$50; on setting curb, 10c. per lineal foot, total, \$524.20; on furnishing and setting curb, 30c. per lineal foot, total, \$609.30; on foundation, furnace slag, 40c. per square yard, total, \$5,300; on furnishing brick and paving, \$1.45 per square yard, total, \$18,850; grand total, \$28,389.25.

George Welsh, on furnishing curb, bid 32½c. per lineal foot.

NEW HAVEN, CONN.—Bids for the construction of the almshouse at Springdale Farm (plans by Allen & Tyler) were opened June 23. We give the more important ones:

Masonry: Bates & Townsend, \$106,570; George A. Baldwin & Son, \$111,343; George M. Grant, \$105,640; J. N. Leonard & Co., \$112,040; E. H. Sperry, \$103,962; Tracy Bros., —; P. Maher, \$120,478.

Carpentering: Tracy Bros. (including painting), \$63,000; N. Countryman, \$62,000; Charles D. Loveland, \$58,670; Larkins & Langley, \$57,147; W. A. Lincoln, \$61,000; David H. Clark, \$57,063.

Iron stairs: Bates & Townsend, \$5,775; George A. Baldwin & Son, \$6,275; George M. Grant, \$6,300; J. N. Leonard & Co., \$5,350; E. H. Sperry, \$5,775; Tracy Bros., \$4,200; P. Maher, \$5,500.

Steam heating: H. B. Smith & Co., \$15,250; New Haven Steam Heating Co., \$14,980.

NEW YORK CITY.—The following bid was opened June 29 by the Board of Education for steam-heating in school house as follows: P. Carraher, \$793.

LAWRENCE, MASS.—The special committee on rebuilding the burnt Union Street bridge has opened bids for constructing a five-span bridge—Boston Bridge Company, \$39,790, to finish it between January 1 and 15; Niagara Bridge Company, \$37,300, to finish it between December 1 and 15; Rochester Bridge Company, \$35,000, to complete it by December 1.

At a meeting of both branches of the City Council it was voted to immediately rebuild the temporary bridge washed away June 18, and to give authority to the joint committee to so rebuild it.

JERSEY CITY, N. J.—The following bids for furnishing 900 lengths of 6-inch, 60 lengths of 8-inch, 40 lengths of 10-inch cast-iron pipe, were received by John Watt, Esq., June 27:

R. D. Wood & Co., Philadelphia, delivered at Morgan Street dock, 6-inch, \$37.80 per ton; 8-inch, \$37.80; 10-inch, \$37.30; at Communipaw Station of the New Jersey Central Railroad, 6-inch, \$37.80 per ton; 8-inch, \$37.80; 10-inch, \$37.30.

M. J. Drummond, New York City, \$37, \$37, \$37, and \$37, \$37, respectively.

John Fox, New York City, \$36, \$36, \$35.50, and \$35.50, \$35.50, respectively.

J. J. McKenna, New York City, \$36.40, \$36.40, \$36.40, and \$35.90, \$35.90, \$35.90, respectively.

ALBANY, N. Y.—The contracts for lengthening 13 of the 16 locks on the Erie Canal have been awarded as follows: Lock No. 32 to Soule & Raynor for \$23,991.50; Lock No. 33 to Soule & Raynor for \$26,200; Lock No. 31 to Clinton Beckwith for \$21,070; Lock No. 46 to Faas & Ford for \$15,117.50; Lock No. 62 to B. P. Smith for \$26,509.20; Lock No. 44 to Daniel Ford for \$28,114; Lock No. 45 to John Moor for \$28,403.75; Lock No. 53 to John Moor for \$22,276.50; Lock No. 55 to John Moor for \$34,986; Lock No. 46 to John Moor for \$28,502; Lock No. 57 to Hughes Brothers for \$25,895.50; Lock No. 61 to Hughes Brothers for \$26,175. The appropriation for the work was \$375,000, and the total amount of the bids is \$331,089.75. The bids for Locks Nos. 34 and 35 were thrown out because there was but one bid on each.

Proposals for enlarging Locks Nos. 34, 35, and 75, Erie Canal, together with two for Champlain Canal, are asked for.

ROCHESTER, N. Y.—The contract for building a factory to cost \$35,000 has been awarded to Messrs. Ellsworth and Grant.

KANSAS CITY, MO.—A building is to be erected for the Goodin Exposition Company to cost \$350,000.

THOMASVILLE, GEO.—The contract for the bridging of the South Florida and Georgia Railroad has been awarded to Messrs. Baker and Pittman of this city.

DETROIT, MICH.—The contract to erect a building to cost \$28,000 has been awarded to Messrs. Tappan and Fisher.

STILLWATER, MINN.—The contract for building the jail has been awarded to Messrs. F. H. Lemon & Co., cost, \$19,850.

GOVERNMENT WORK.

SYNOPSIS of bids for hydraulic passenger elevator for Custom-House, etc., at Buffalo, N. Y., opened June 27 by the Supervising Architect of the Treasury Department: Crane, Elevator Co., \$3,500; Howard Iron Works, \$5,327; Elias Brewer, \$5,995; George C. Howard, \$8,000; George C. Howard (no cistern or pump), \$7,700; Ellithorpe Air-Brake Co., \$6,500.

WASHINGTON, D. C.—The Bureau of Yards and Docks opened bids June 29 for two timber dry-docks complete, with iron caissons, boilers, engines, etc. The docks are to be from 480 to 500 feet long and 125 feet wide between copings, 40 feet wide on floor, 25 feet 6 inches depth on sill, 80 feet wide at entrance. The docks are to be located one at Norfolk, Va., one at Brooklyn. The bidders were:

J. E. Simpson & Co., New York City, for both docks, \$1,061,600.

O'Connell & Coffey, Brooklyn, N. Y., for New York timber dock, \$525,000.

DALLAS TEXAS.—Synopsis of bids for iron work for roof of Court-House, Post-Office, etc., opened June 28, 1887, by Supervising Architect, Treasury Department: Marshall Foundry and Construction Company, Pittsburg, Pa., \$7,025.69; Missouri Valley Bridge and Iron Works, Leavenworth, Kan., \$9,100.

SYNOPSIS of bids, opened June 27, by the Light-House Board, for furnishing and delivering two second-order lanterns, one for Moose Peck, Me., and the other for Lembyat Head, Mass., Light Station: The Allentown Rolling Mills, Allentown, Pa., \$5,577.60; Robt. Daly & Co., New York City, \$7,600; The Portland Company, Portland, Me., \$7,800; H. A. Ramsay & Son, Baltimore, Md., \$7,942; The Colwell Iron Works, New York City, \$9,375.

Contract awarded to the Allentown Rolling Mills.

SYNOPSIS of bids for steam heating for Court-House, etc., at Rutland, Vt., opened June 27, by Supervising Architect, Treasury Department: L. E. Milles, Salem, Mass., \$2,245; A. Calhoun, Middlebury, \$3,165; Edward T. Bates, \$2,700; Bartlett, Hayward & Co., Baltimore, Md., \$2,050; Walworth Manufacturing Company, \$2,387; New Haven Steam-Heating Company, \$2,800; Johnson & Morris, \$2,830; Lee, Chamberlain & Co., Troy, N. Y., \$2,800; Baker, Smith & Co., New York, \$3,272; Pierce, Butler & Pierce Manufacturing Company, \$2,576.

SYNOPSIS of bids for labor and material for the carpentry work, etc., required to enclose the Court-House, etc., at Macon, Geo., opened June 28, 1887, by Supervising Architect Treasury Department: Hendrix & Willingham, Macon, Geo., \$9,600; John Mitchell, Louisville, Ky., \$6,945; Harris & Co., Newport, Ky., \$6,327.

MISCELLANEOUS.

TROY, N. Y.—The Watervliet Arsenal Works will be rebuilt for the manufacture of heavy ordnance.

JACKSON, TENN.—At a city election, June 14, to decide on the issuing of bonds for \$34,000 to provide for the erection of a stand-pipe, the proposition was defeated.

A **SCHEME** is on foot, said to be engineered by substantial backers, which has for its object the formation of a through line via the Poughkeepsie bridge, between the coal regions of Pennsylvania and the manufacturing centers of New England. The uncompleted Pennsylvania, Slatton and New England is to form the western end of the new line, while the Hartford and Connecticut Western is said to be controlled in the same interest, and by the construction of a number of short branches or the formation of alliances, will give connections with a number of important New England points.

The Town Board of Patchogue, L. I., has established a new system of water-supply by tapping Second Lake and laying iron pipes through the village.

BROOKLYN.—The Executive Committee of the consolidated Brooklyn Union Elevated Railroad Companies has closed a contract with the Rhode Island Locomotive Works, of Providence, for forty-five improved locomotives, making, with six now under way, fifty-one motors to be used on the lines of the corporation. The first batch will be ready for delivery by January 1, and the entire number by the 1st of next May. The engines are to be a heavier model than now in use on the Brooklyn line, and embrace the latest improvements in light locomotive building.

A contract has also been made with the Gilbert Manufacturing Company, of Troy, for 150 new passenger cars to make up the needful trains. The first thirty of these are to be delivered in December.

SANTA CRUZ, CAL., has voted to spend \$80,000 on various city improvements.

CHICAGO.—A bill passed the State Legislature providing for the building of a sea wall for Lincoln Park, at a cost of \$300,000. Address Mr. Goudy, President of the Lincoln Park Board.

FREERPORT, ILL.—Surveys have been made for the Freeport, Dodgeville, and Northern Railroad.

BUILDING INTELLIGENCE.

PEABODY, KAN.—A 3-story hotel will be built here.

LYONS, KAN.—An opera-house will be built here.

FOND-DU-LAC, WIS.—In progress, St. Joseph's Church, corner of Marr and Second Streets.

NEW YORK CITY.—The Madison Square Garden Company will make extensive improvements in the property, which they have just bought.

WINONA, MINN.—The shops of the Winona and South-western Railroad will be built here.

WINCHESTER, CONN.—A \$10,000 court-house will be built.

MINNEAPOLIS, MINN.—Ridgewood av, bet Lyndale and Lyndley avs, fr dwell: cost, \$7,000; o, W. W. Bayles.

Cor Hawthorne av and 16th st, fr dwell: cost, \$7,000; o, E. C. Cauvet.

24th st, bet 28th and 29th avs, br school bldg: cost, \$23,951; o, Board of Education; a, Long & Kees, b, H. E. Selden.

8th av, n, bet Hoag and Bradford, br dwell: cost, \$10,000; o, C. A. Anderson.

42d, and Minnehaha av, fr dwell: cost, \$8,000; o, W. R. Moffatt.

Lake of Isles Boulevard, fr dwell: cost, \$7,000; o, W. P. Douglas.

4th st, br horse house: cost, \$9,000; o, City of Minneapolis.

BUILDING INTELLIGENCE.

(Continued from page 116.)

CINCINNATI, O.—A factory costing \$20,000 will be built by the Sagendorph Iron Roofing Co.

SAVANNAH, GEO., is to have a new hotel. For further information address J. A. Wood, 76 Chambers St., N. Y. City.

SAN FRANCISCO, CAL.—A new church costing \$100,000 is to be built for the Unitarians.

PROVIDENCE, R. I., is to have a new opera house. For further information address Col. Francis L. O'Reilly.

SAN FRANCISCO, CAL., is to have a cathedral costing about \$200,000.

DETROIT, MICH.—The Chapoton Bldg Co. have been awarded the contract for a building to cost \$45,000.

KANSAS CITY.—42 bldgs costing less than \$7,000.

ROCHESTER, N. Y.—The State Industrial Home Association will erect a building to cost \$110,000.

PUEBLO, COL.—The Denver, Texas and Gulf R. R. will build a passenger and freight depot at this place to cost \$20,000. For further information address B. N. Grove, Superintendent, Denver.

WASHINGTON, D. C.—A building to cost \$1,000,000 will be erected in this city by Mr. Levi P. Morton.

PITTSFIELD, MASS., is to have a new Episcopal Church, costing \$50,000.

PEORIA, ILL.—A Druid Temple will be erected in this city at a probable cost of \$20,000.

CINCINNATI, O.—New works, costing \$85,000, will be erected by Messrs. L. Schrieber & Sons.

YOUNGSTOWN, O.—Architects Kanengeiser & Kling have prepared plans for the new Catholic church at Niles, O., to cost \$12,500. The same firm are also preparing plans for the residence of C. E. Tillotson, Greenville, Pa., to cost \$7,000.

WINCHESTER, MASS.—In progress, town hall.

BRISTOL, TENN.—John H. Ingham, of New York City, can give information about an extensive improvement scheme here, including furnaces and factories.

SHREVEPORT, LA.—A hospital will be built here to cost \$12,000. L. A. Parisher is the contractor.

CROWLEY, LA.—The contract to build the court-house has been let to Hannan & Voss, of Baton Rouge, at \$11,000.

DONALDSONVILLE, LA.—The police jury will receive bids for building a court-house.

LEXINGTON, KY.—Belknap & Dumesnil, of Louisville, have the contract for building the court-house here, at \$31,000.

BOSTON.—The Department for the Survey and Inspection of Buildings have, during the past week, issued permits for about eighteen wooden tenement houses and stables, the average cost of which will be about \$2,000.

The Sewall & Day Cordage Company has made arrangements to remove its extensive works from the Roxbury District to the Brighton District, at which latter point about thirty acres of land have been purchased on Western avenue, near Everett street. The company will at once begin the erection of two buildings, one of which is to be of brick and stone, 88x118, two stories in height, with a flat roof, and the other 81x95, one story in height, with flat roof; the rope-walks are to be 1,738 feet in length, with a width varying from 28 to 42; and a planing mill of wood is to be 96x40. Cutting & Bishop of Worcester, are the architects.

OAKLAND, CAL.—Address the Christian Brothers about the new buildings to be erected on Broadway, at a cost of \$25,000.

CHICAGO, ILL.—1264-70 W Lake, br at flats, cost, \$28,000; o, James L. Campbell; a, C. A. Weary; b, owner.

190 Cass, br flats; cost, \$7,100; o, Jas Sullivan; a, Geo G. Spohr; b, Jno Woodstrom.

711 N Harriet, br flats; cost, \$10,000; o, Augt Kirchhoff; a, Ruger & Snorr; b, Jno P. Flick.

2310 Portland av, br flats; cost, \$7,100; o, Anton Martin; a, J. P. & J. F. Doerr; b, Lash & Williams.

417-19 Centre, br dwell and addn; cost, \$9,000; o, H. Forrest; a, Schaub & Berlin; b, Jos Hodgson.

77-89 Washington, addn to office bldg; cost, \$75,000; o, U S Express; a, W W Boyington; b, Robinson & Miner.

934 Ashland av, br and at flats; cost, \$12,000; o, Aug Stude; a, H. Hildinger; b, H. Grosser.

147 Blackhawk, br st and flats; cost, \$8,000; o, M. Lunder; b, I. Stasiowski.

246-54 Franklin, br dwell; cost, \$30,000; o, Estate of Nathan Boddie; a, Fred Baumann; b, L. J. Dargling.

Michigan av, Wabash av and Congress, 10-story and bsmt at auditorium and hotel, 360x137 feet; cost, \$2,000,000; o, Chicago Auditorium Ass'n; a, Adler & Sullivan; b, Jno Angus.

3833-35 State, br st and flats; cost, \$7,100; o, J. W. Cochran; a, H. H. Boyington; b, J. J. Rogan.

LANCASTER, PA.—Address Rev. John F. Crouch, of the Duke Street Methodist Church, about a new edifice.

BIRMINGHAM, ALA.—Morris & Underwood are the owners of a \$25,000 building to be erected here; Belton Gilreath, contractor.

ELMHURST, ILL.—Frame and slate dwell, cost, some \$10,500; o, Mrs J R Case; a, C. H. Tilton.

GENEVA, ILL.—St and slate dwell, cost, \$12,000; o, Mr. Orton; a, Cleveland.

WORCESTER, MASS.—Nothing to report this week over \$7,000.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 6. } PUBLISHED EVERY SATURDAY.

NEW YORK, JULY 9, 1887.

LONDON, JULY 23, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

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Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

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THE CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE convention at the Hotel Kaaterskill, now just closed, has been one of the most successful in all respects that was ever held, being made all the more so from the charming character of the resort selected for the meeting. There were some 300 members and guests, and all branches of the profession were ably represented.

The Committee of Arrangements had most thoroughly anticipated all the requirements of the occasion, and everything passed off without a hitch. Those who attend such gatherings are too often oblivious to the labors and pains taken by brother members for their comfort, and the latter are rewarded more by fault-finding than praise. We are glad to be able to say, however, that in the present case the committee were most pleasantly remembered.

There were some ably-sustained and important discussions, both written and oral, on a number of practical subjects, and a large number of very interesting and important papers and reports.

We shall present hereafter such portions of these as we think will interest our readers.

We do not think our remarks of last week convey the idea, as stated by a correspondent in another column, that "too much attention is paid to the social side" at these gatherings. We certainly had no such intention in what was written. If all the quiet talks on scientific subjects between members of the convention could be written out, it would be found that if nothing else had been accomplished, the professional gain would be great. But it is no slight gain to be able to throw off the shop and meet brother members socially with their wives and daughters, and learn that every man has another side to his character, perhaps unsuspected before, but which is only drawn out under such conditions. In other words, to see that engineers are citizens, fathers, brothers, husbands, as well as machines absorbed in their special work. There is very little danger that engineers will be carried away by the festivities of such an occasion; a week in their offices will quickly remove the poetry of the meeting. Let us hope that all will return to their work with renewed vigor, and all the better able to cope with it from the brief unbending of the professional bow.

LONDON WATER-SUPPLY.

THE report of Mr. A. de C. Scott, the Water Examiner under the Metropolis Water Act of 1871, made for the month of March, 1887, contains some interesting data. London is supplied with water by eight private companies, who furnished water to 722,263 houses during the month. The total daily average supply was 152,224,619 gallons, being about 28 gallons per head for an estimated population of 5,356,982. About half of this comes from the Thames, 37 per cent. from the Lee, and the remainder from springs, wells, and ponds. The number of houses receiving constant supply is 353,237, and 1,178 miles of streets contain mains constantly charged, in connection with which fire-hydrants are, or can be, fixed.

Seven of the companies have storage reservoirs, and carry out a process of filtration through sand and gravel. The subsiding and storage reservoirs for unfiltered water cover about 465 acres, and have an aggregate capacity of 1,290,100,000 gallons. There are 54 covered

reservoirs for storage of filtered water, having an aggregate capacity of 160,252,000 gallons. The results of the chemical and bacteriological examinations made during the month are reported as very satisfactory.

DRAINAGE INTO THE LOUISVILLE AND PORTLAND CANAL.

IN response to a resolution of the House of Representatives, at the recent session, asking for information as to the rights of the city of Louisville to drain into the canal, the Secretary of War transmitted a letter upon the subject. An examination of the laws of the State and the United States shows that the title was acquired by the general Government under a law of the State of Kentucky, approved February 22, 1854, but it was not until February 8, 1855, that full title was obtained, excepting five shares.

March 28, 1872, the State Legislature passed a resolution directing the president and directors to surrender the canal, and all property connected therewith, upon the condition, among others, "that the city of Louisville shall at all times have the right of drainage into the said canal; provided, that the connections between the drains and the canal shall be so made as to keep out mud and garbage."

The report by Major Stickney, U. S. Engineer, shows that this latter condition was never agreed to by the general Government; also, that the drainage from a number of sewers into the canal causes a very offensive and disagreeable state of affairs, as the sewage from nearly two square miles now takes this direction. It is only a question of time, therefore, when some change will be imperative. As the canal stops direct access to the Ohio River, the sewers must be carried underneath by syphons, or an intercepting-sewer parallel to the canal be built. The latter is recommended, and as, from the nature of the case, it is a hardship to the city, the recommendation is made that the Government bear a portion of the expense.

SANITARY CONDITION OF HEALTH RESORTS.

IN a paper on the sanitary police of watering places and health resorts in France, presented to the French Society of Public Health, Dr. Bouloumie explains briefly why it is that the present system of inspection and supervision of these plans, which in theory is quite elaborate and careful, amounts to nothing in practice.

The chief object of the local medical inspector or health officer at such a place is to get practice among the visitors, and to obtain this he needs the good will of the proprietor the hotel-keeper, etc., etc. He must be prepared at all times to certify to the excellence of the sanitary arrangements, to prove that the water is good, the sewerage superb, and that any alleged cases of typhoid are either not typhoid or have been contracted elsewhere.

It is, of course, quite different with the physicians of our own health resorts, but perhaps it will tend to keep them thoroughly conscientious and disinterested in their opinions if sufficient skepticism be maintained to demand additional evidence as to the healthfulness and sanitary condition of these places of public resort. We observe that even State Boards of Health are sometimes very reluctant to tell the truth to the public about the health resorts which are under their jurisdiction, so that it is no wonder that local health officers should lean—just a little.

OUR BRITISH CORRESPONDENCE.

New Reservoir for Lille—Cutting Down Expenses—Sanitary Registration of Buildings Bill—Edinburgh Library Architectural Competition—Transference of Rights of the Sheffield Water Company—Branch Association of Sanitary Inspectors of Liverpool.

LONDON, June 22, 1887.

A NEW reservoir for the water-works of Lille is in course of construction. It is a rectangular brick structure in two equal water-tight compartments, with a total capacity of 2,600,000 gallons. It has an 18-inch concrete floor and walls 15 feet 6 inches high at base, tapering to 5 feet 4 inches at top. A straight slope—the chord of the curve—has been adopted instead of curved walls, to correspond to the resistance required. The arched roof over the reservoir is built on independent pillars fifteen feet high, the object being to relieve the walls of extraneous strain.

pointed for the purpose) has just issued its report, and objects to the bill *in toto*, principally on the ground that there is no guarantee of the competency of these experts. Further, it points out that the bill proposes to license the existing incorporated sanitary associations, and that such license in sanitary practice would give any such association authority to give unchallengeable certificates of sanitary perfection. The report further points out that the bill has been promoted by a sanitary association, and that therefore it is not unfair to assume that the primary reason for its introduction is to be found in the desire to encourage such bodies.

A quibble which has been raised by the authorities in the Edinburgh Library architectural competition is more creditable to their ingenuity than to their sense of justice. Two out of the three premiums were assigned by Mr. Waterhouse to two gentlemen who were acting as assistants to principals, one of whom was Mr. Dunn, of the Borough Engineer's Office, and the other, Mr. Lumsdaine, of the Office of the Superintendent of Public

present time is £1,226,200 (\$5,887,360) of the former and £489,800 (\$2,351,040).

Credit is due to the promoters of the Association of Sanitary Inspectors for bringing the duties status of the Sanitary Inspector out of the unsatisfactory position they held towards the public generally. The sanitary inspectors of Liverpool and district, recognizing the fact that the meetings of the parent association have been of great value in disseminating information and affording mutual support, have decided on forming a branch association. Some of the members have in view the desirability of a superannuation scheme which is to be the result of cumulative payments. It is difficult to see how the inspectors, under the existing circumstances, could contribute to such a scheme, as their salaries in some country places range as low as £50 (\$224) per annum.

SAFETY-VALVE.



RESIDENCE AT YORK HARBOR, ME.—ANDREWS & JAKES, ARCHITECTS.

The Ventnor (Isle of Wight) Local Board is evidently an admirable body in its desire to cut down expenses and decrease the rates, but, unfortunately, these economical propensities are taking a very unwholesome direction. In addition to giving the general corporation employees three months' notice to leave and cutting down the wages by various sums, they have decided to suspend the flushing of the sewers. The clerk to the board is offered £20 less (\$96) per annum, the surveyor £50 (\$240), the sanitary engineer £14 (\$67.20), and the rate-collector £12 (\$57.60). The surveyor, who is an experienced official, has already found another engagement. Seeing that Ventnor, being in the Isle of Wight, is one of the leading health resorts, the board will probably have to "perpetrate" fresh economies in a year or so if they persist in the present method.

The National Health Society has taken very decided ground against the proposed Sanitary Registration of Buildings bill, the text of which has already appeared in the columns of THE SANITARY ENGINEER and CONSTRUCTION RECORD. The sub-committee of the society (ap-

Works. Objection is taken to the award on the ground that the recipients are not architects carrying on business in Edinburgh. The definition in this case is very fine, and requires a Scotch mind to comprehend thoroughly.

The Sheffield Corporation and the Directors of the Sheffield Water Company have come to an agreement as to the transference of the rights of the Water Company to the corporation. The terms are, I think, unusual. The transfer will be as from January 1, 1888. The corporation will take over the debenture debt, and will grant to the holders of preferential and ordinary shares, to the former 4 and 5 per cent. for every £100 share of the capital, and to the latter 2 per cent. for 1888 and 1889; thence to 1894 $\frac{1}{4}$ per cent. increase for two years, after which time the amount will be 4 per cent. Ordinary shares may have, at the holder's option, either a fixed annuity of £3 (\$14.40) for every £100 (\$480) or a compound of £82 (\$393.60) in cash. The Chairman and Manager will receive £3,000 (\$14,400) each as compensation. The dividends for the last five years have been at the rate of $2\frac{1}{2}$ per cent. per annum, and the total amount of shares and loans at the

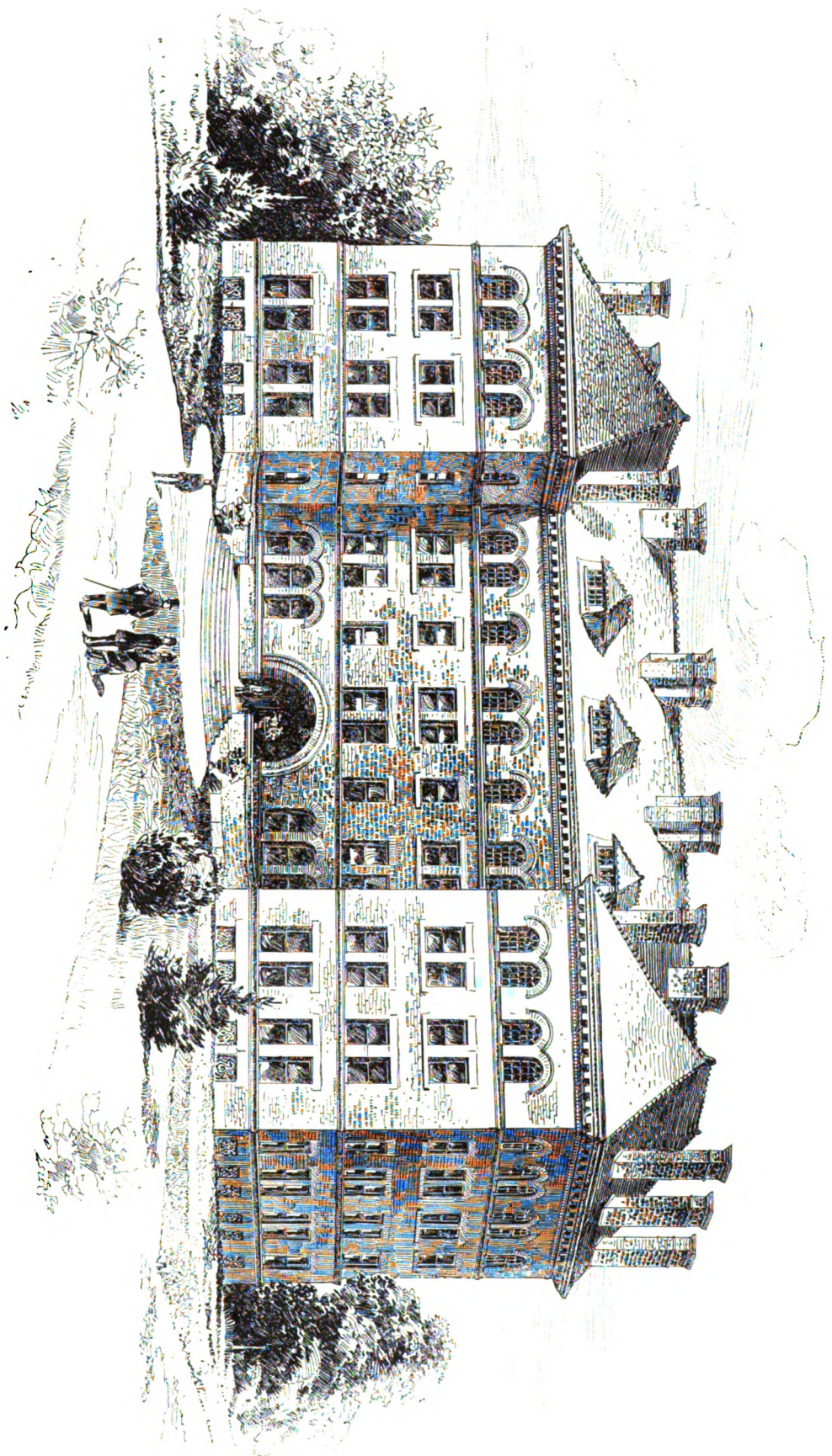
OUR SPECIAL ILLUSTRATION.

NEW DORMITORY, M'CORMICK THEOLOGICAL SEMINARY, CHICAGO.—A. PAGE BROWN, ARCHITECT.

THE subject of our special illustration this week is the new dormitory of the McCormick Theological Seminary, Chicago. It is built of St. Louis brick and Vert Island stone; cornice of stone; interior of first floor of oak, others of yellow pine; iron staircase, elevators, etc.; vestibule of marble, mosaic, etc. It contains study, suites of rooms, besides two recitation-rooms on first floor. Cost was \$110,000. The architect was A. Page Brown, of New York.

OUR VIGNETTE ILLUSTRATION.

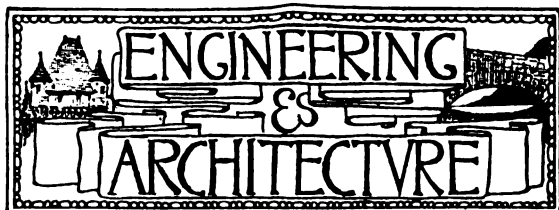
OUR vignette illustration is of the house of Mr. John C. Ropes at York Harbor, Me. It is of spruce, frame, clapboarded, cedar shingles on roof. House fronts directly on the ocean, and for that reason the piazzas were made especially large and capacious. The architects were Messrs. Andrews & Jaques, of Boston.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

DORMITORY OF THE MCCORMICK THEOLOGICAL SEMINARY, CHICAGO, ILL.

A. PAGE BROWN, ARCHITECT.

RECEIVING AND CATCH BASINS, WATER-
BURY, CONN.

THROUGH the courtesy of Mr. F. Floyd Weld, City Engineer of Waterbury, we have been enabled to make illustrations of the two forms of basins herewith presented. All engineers who have to do with sewers in steep streets have encountered the difficulty, that the water tends to flow past the basins, and in consequence to flood the gutters at the foot of the grades. To remedy this Mr. Weld uses a receiving-basin similar to those used in Providence, in combination with a catch-basin. The sketch plans show the way in which they are placed. When on two sides of a corner they are about 15 feet from the angle, depending, of course, upon the relative grades, but far enough away to avoid the nuisance of a corner entrance.

There were 14,225 feet of sewers put down during 1885, ranging from 8 to 50 inches, and the total length of streets sewered was on January 1, 14.87 miles. In this important work Mr. Weld has had the able assistance of Mr. Frank W. Whitlock and Mr. H. J. Kellogg.

A careful system of flushing and cleansing all sewers is kept up. Where a flush does not cleanse away the adherent furring of grease and other filth, a scraper made of wood, with rubber flanges, is drawn through the pipes from one manhole to another, and effectively cleans them.

THE REPAIR AND MAINTENANCE OF ROADS.

BY W. H. WHEELER, M. INST. C. E.

(Continued from page 98.)

STEAM rolling is in every way better and more economical than horse rolling, and that the advantages arising from the use of these rollers are economy, facility of perfect construction, comfort to persons and horses using the roads, improved surface, diminishing the wear and tear of vehicles, saving of material amounting to as much as 25 to 50 per cent.

In Paris the method of repairing macadamized roads consists in having the stones broken to such a size that no stone weighs more than five ounces. The interstices are filled with sharp sand. After the road is completed it is maintained in order by constant watering and sweeping.

with a machine—the sweeping following the watering, and the surface being made thoroughly wet, so that the machine will work easily. This is done early in the morning, before the traffic is about. In warm, dry weather the road is frequently watered during the day with hose from stand-pipes, the surface being only moistened : and not made thoroughly wet. In many towns in this country water is poured on to the surface of a road covered with dirt, so that a sea of mud has to be waded through by persons having to cross the road, and their boots become covered with mud on the brightest summer day. This mud soon after dries, and is carried in clouds of dust over the goods in the shops and the clothes of the passengers.

The repair of country roads is a much easier task than that of town roads. The amount of traffic is so small that with ordinary skill, care and attention there ought to be no difficulty in keeping the highways of this country in excellent order at a small cost.

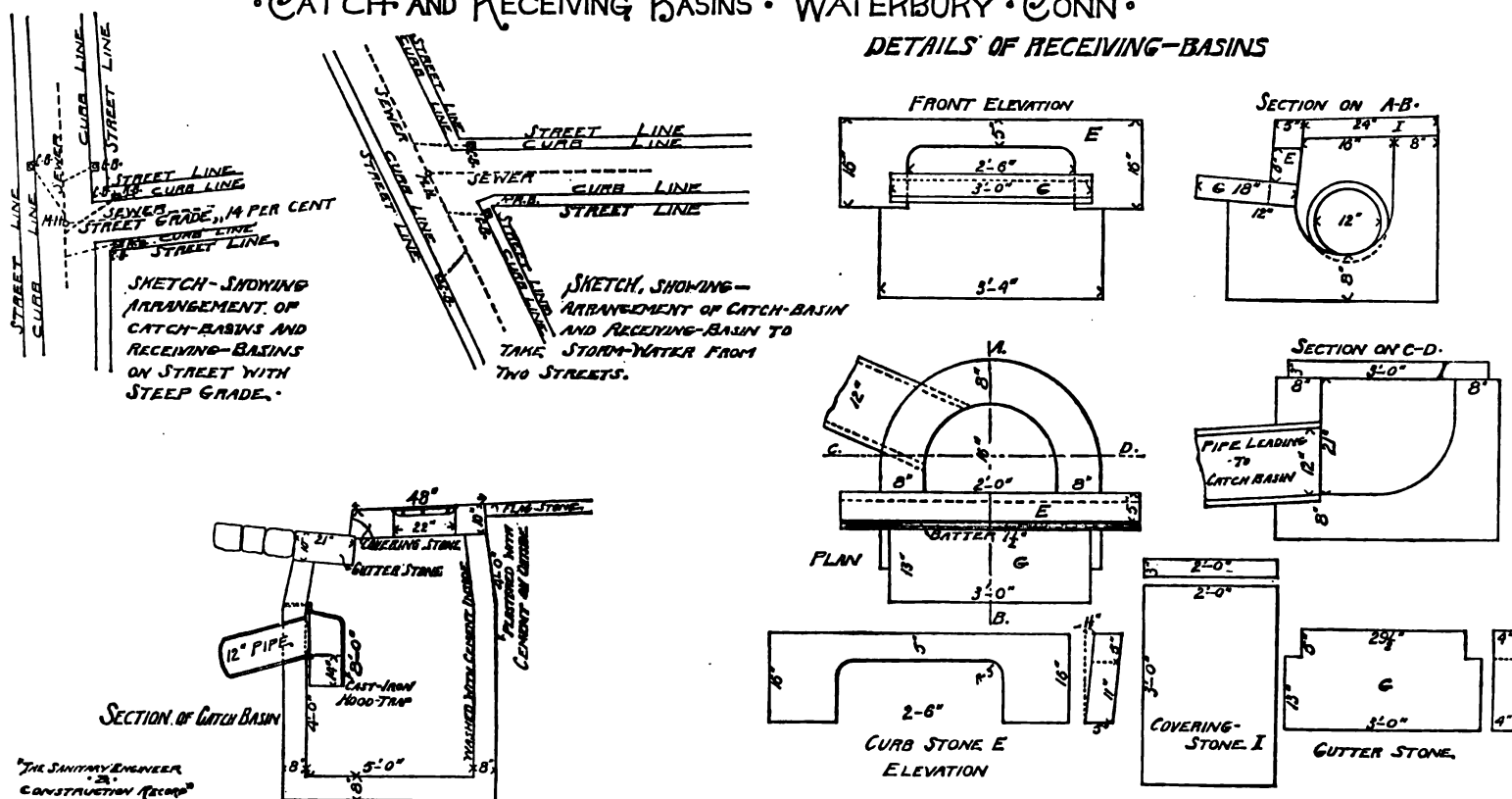
The main points to be observed are : The constant care on the part of the roadman never to let his road get out of order; in no case does the old proverb, "A stitch in time saves nine," apply more forcibly than to road repair; the use of good materials; proper attention to surface drainage; cleaning the mud off in wet weather; removing all loose stones in dry weather.

The roadman should never lose sight of the fact that loose stones are annoying to every user of the road, and always more or less dangerous.

One very essential matter that requires the attention of the roadman is the scraping and cleaning the mud arising

• CATCH AND RECEIVING BASINS • WATERBURY • CONN. •

DETAILS OF RECEIVING-BASINS



When at the side of a steep street, the catch-basin is placed 10 to 15 feet above the corner, and the receiving-basin a few feet further up.

To deflect the water, a thick piece of stone is set on edge near the lower edge of the respective entrances, and raised about 6 inches above the gutter-stone, the paving being shaped so as to avoid making a nuisance to vehicles.

The receiving-basin is simply an opening so shaped as to catch the water and turn it into a 12-inch pipe leading to the catch-basin. Of course, no trap is required. The drawings explain themselves.

The catch-basin is a modified form of one in use in many places. It will be seen that the hinged iron hood trapping the sewer connection has a seal of 14 inches below the bottom of the pipe, being deeper than they are ordinarily made. Again, it was found that in places where the ground was wet, the surrounding soil would freeze fast to the outside of the basin, and the consequent heaving would cause a circumferential crack in the basin, such as at times to destroy the seal.

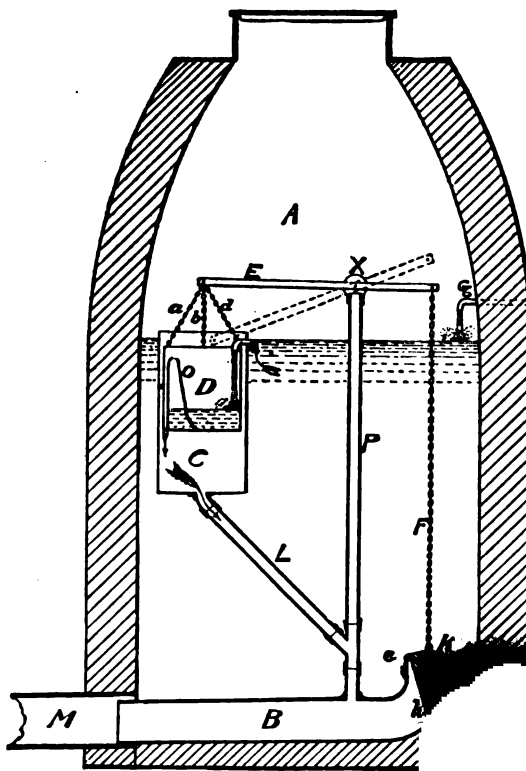
The bottoms of the basins were then enlarged 8 inches in diameter, and the upper portion made sloping as shown and smoothly plastered outside with cement mortar, since which time no trouble has been experienced. In building new basins, the outside is laid up 4 inches thick, and the inside is made largely of bats, and with a collar of cement between, there being no bond between the inside and outside. As a further precaution the inside is washed over with thin cement grout to fill any defects in the work. The result has been that the work is perfectly tight.

from the wearing away of the materials and the droppings of the horses. It is impossible for the wet to evaporate quickly when the surface is covered with mud. In winter it acts like a wet blanket, preventing the sun and wind from drying the road, and in summer it causes clouds of dust. A road that has not been scraped will remain wet and dirty for several days after an adjoining road, which has had the mud removed, has become quite dry. No road surface can be kept hard, nor can ruts be prevented where mud is allowed to accumulate and remain on the road. To prevent mud forming in wet weather the dirt should be removed in summer. It should be borne in mind that the summer dust makes winter mud, and that it requires much less labor to remove the dust from the roads in summer than the mud in winter.

At the sides of all roads maintained in good order a gutter is formed, and these should be kept clear and free from grass and weeds. They should always be laid out by a competent person, and suitable outfalls made for the water.

The chief requisites of a material for repairing roads are, that it should not only be hard, but tough, and that its composition should be such as that it shall not easily be affected by the weather. For the best road the fragments should be angular and cubical, so as to bond well together, each stone should fit against and be wedged compactly up to its neighbors, as in a piece of mosaic-work, and no space left for water to penetrate.

The materials used must, to a certain extent, depend upon the locality, but it is far more economical to use good material, although it has to be brought from a distance, than inferior local stone procured at less cost. No material is so efficient and really economical as granite or some of the hard volcanic rocks. Even in first cost it is cheaper than gravel, limestone or slag. There is less labor and in putting a durable and lasting material on roads than that is more perishable and requires frequently



• *SECTIONAL VIEW*

Some of the harder limestones and sandstones make fairly good roads. In damp weather in summer they make pleasant roads, but the former especially, although hard and tough, becomes disintegrated rapidly by frost, and both wear into dust in dry weather, and make roads dirty in wet and dusty in dry weather.

The softer kinds of limestone are utterly unfitted for repairing good roads.

Flint gravel makes a clean road and if properly attended to gives a firm surface, but not a very even one. If the gravel is picked off the land or taken from the bed of a river it consists of stones of different degrees of hardness which wear unevenly, and all gravel is more or less round. Even if thoroughly broken there is left one part of the stone which has a rounded surface. Sea shingle and gravel, consisting of rounded pebbles, although clean and hard, never consolidate. Round gravel is one of the worst and most dangerous materials that can be used for roads. If the gravel becomes consolidated in winter it is certain to work loose in the following summer. The constant tendency of all stones having rounded surfaces is to roll round one another when weight is brought on them, and so work loose.

The materials to be avoided are those that are quickly converted into mud or dust and that work loose, and preference should be given to those that, avoiding these evils, make as even a surface as practicable and seldom require repair. The question of first cost, within reasonable limits, need not be considered, as the better the material, the less of it is required, and the less the labor and carting.

With regard to the size to which the fragments should be broken, opinions vary considerably. The old rule was that no stone that would not pass through a two and a half inch gauge should be used for the surface repairs. More recently smaller sizes have been advocated, and the element of weight as a standard advocated. The following standard has been recommended:

	Maximum Weight.	Minimum Weight.
Granite and similar rocks.....	3½ oz.	½ oz.
Flint and similar stones.....	5 "	¾ "
Limestone and similar stones.....	6 "	1 "

One-half of the total quantity to be of the maximum weight, one-eighth of the minimum weight, the remainder to be composed of stones varying between these.

There is no doubt that the hard and tough rocks should be broken into smaller fragments than those that are softer. For ordinary country roads the cleaner and more even the size of the stone the better, as there is always in the road plenty of loose material for bedding the new stones. The author's experience leads him to give as his opinion that for the repair of a main road in rural districts, where granite or similar hard material has not been long used, the size to pass through a two and one-half inch gauge is not too large. If the fragments are smaller than this they are squeezed into and lost in the softer material, their size not being large enough to give sufficient bearing surface to withstand the weight of the wheels of heavy vehicles.

After granite has been used for some time and the road has become fairly coated with it, so as to give a good resisting surface, a size to pass through a one and three-quarter inch gauge is sufficiently large to fill up the depressions. If a smaller size than this is used it will not stand the crushing of the wheels, and soon becomes dust.

All stone should, when practicable, be carted and placed in heaps at the sides of the road during the summer, when the roads are hard. The material is then ready as wanted, and there is less wear and tear on the road by carting than if it be done in winter. All stones harden by exposure to the weather. Stones that have been lying during the summer in heaps will wear longer than those brought directly from the quarry.

As far as practicable materials for repairs should be placed on the roads in the early part of winter to allow of its being thoroughly bedded and incorporated with the old material. As a matter of experience it has been found that stone put on in the early spring, although apparently well bedded and set, will work out again much sooner than that put on in November and December. If it is necessary, as will sometimes be the case, to place the stones on the road at other times than in winter in order to fill up depressions or to prevent the formation of ruts, the surface should be loosened with the pick, the stone evenly spread and covered with road-scrappings. If this be carefully done the place so repaired will soon become as firm and as level as the rest of the road. For repairs of this kind only the smallest kind of material should be used. Many surveyors keep a supply of granite chips purposely for the repair of hollows and defective places in summer time.

It may be taken as a fair estimate for the main roads of this country, excluding the strictly urban portions, that a mile of road will require 40 tons of granite to repair it, and that one man can keep in order four miles of road. Putting the granite at \$2.50 per ton, and the wages \$1.25 a day, this, with an allowance for carting, extra labor, and incidental expenses, would give \$175 a year as the cost per mile. After a road has been thoroughly well coated with granite, the quantity of material required will decrease considerably. On the other hand, roads which have previously been repaired with soft and inferior material will require a larger quantity of material and more labor.

SEWERAGE OF ST. JOHNS, NEWFOUNDLAND.

In a report to the Colonial Secretary by Mr. H. C. Burchell, Government Engineer, a very full description of the existing and proposed systems of sewers in St. Johns is given:

The old sewers are large, varying from 2' x 2' 6" to 3' x 5', and they drain directly into the harbor; "the three conspicuous features of a public cove are, as a rule, a sewer outfall, a public closet, and a fish-stand." All the large sewers are square in section, with mostly dry rubble-stone walls and plank floors, the covering being either of planks or flags. "The efficient trapping and ventilating of house-drains is almost unknown," and the drains discharge into the soil. In addition to all this, large sections of the town are still dependent on wells for a supply of water.

With such conditions it is not strange to learn that some districts of the town "are well known as haunts of diphtheria and typhoid fever." A house-to-house examination was made and a record is given. An evident disposition was evinced among the poorer classes to conceal facts which they imagined might appear to their disadvantage.

The greatest fall of rain during fifteen years past gave 3.69 inches in nine hours, and another gave 3.52 in six hours.

The area to be drained at present is 500 acres, upon which one inch of rainfall would give 11,311,000 gallons, and he estimates a possible amount delivered to the sewers of 12,000,000 gallons in twelve hours or 1½-inch per hour. At 50 gallons per capita per day water-supply, he estimates the sewage proper to be one-sixth of this. Owing to irregular grades and badly constructed bends, the old sewers are often stopped, and the stoppages are more apt to occur from the lack of proper catch-pits or "gulleys" for the gravel, etc., entering from the streets.

After a discussion of the problem, the separate system is recommended for adoption. The old sewers are to be retained for drainage purposes, proper outfalls and street gulleys to be provided.

The scheme provides for 14 miles of 6-inch to 30-inch pipe at an estimated cost (including \$35,000 for an outfall) of \$206,000.

In order to induce persons in moderate circumstances to introduce water closets, it is recommended that a cheap form of closet be furnished by the city at cost.

A set of regulations for sewer connections, the assessment, collection of rates, etc., is appended.

A PAPER on "Class Mortality Statistics" has just been read at the Royal School of Mines, London, by Mr. N. A. Humphreys. The reader quoted the mean duration of life, according to Dr. Farr's English Life Table, as 41; a later table, based on general mortality, increases to 44 years, while the Healthy District Table gives the further increase to 49 years. Ansell's Table of the Upper Classes shows a mean duration of 53 years. Examination of life tables generally showed that child mortality was the controlling element of mean duration. Under 5 years of age, Dr. Farr's Life Table gives the death-rate as 66 per 1,000; Mr. Humphreys' General English Table (more recent than Dr. Farr's) gives it as 61; Dr. Farr's Healthy District Table as 39; and Ansell's Upper Class Table as 28 per 1,000. The proportion of class mortality, 5 to 20 years, is almost as great as that under 5, while the greater vitality in later age periods of the middle and upper class is not quite so strongly marked. The strongest contrast is between the upper and working classes. Dr. Ogies' occupation mortality tables, after making allowances for age differences, taking the mortality of all males 25-65 years at 1,000, gives the following relative mortality statistics: clergy, 556; gardener, 509; farmer, 631; agricultural laborer (country), 701; Cornish miner, 1,839; costermonger, or hawker, 1,879; general laborer, (London), 2,090; hotel servant, 2,205. According to Dr. Grimshaw's Dublin mortality statistical report 1883-1885, the proportion of children per 1,000 in the professional and independent as against the artisan class, showed 75 and 121 respectively. The proportion of persons aged 60 and upwards per 1,000 in the same classes has 150 and 63 respectively. Given identical rates of mortality at each age period, the differences of age distribution gives a death-rate at all ages of 19.5 in the middle and 25.2 in the professional class. Allowing for differences of age and taking 1,000 as the standard of mortality at English Life Table rates, Dr. Grimshaw gives the results for each class as 632 professional and independent, 1,093 artisan, 1,333 middle, and 1,659 general service (including workhouse statistics). The mean annual mortality under five years is five to one in the general service as compared with the professional class. The period of 5-20 years stands at about the same, and above 20 years in the relative periods the proportion is about two to one, between the same classes. The comparison of mortality from specific causes in the same classes—i. e., general service as against independent and professional—shows approximately as follows: Measles, 10 to 1; whooping-cough, 4 to 1; diarrhoea, 3 to 1; scarlet fever, 2 to 1; lung disease, 3 to 1; convulsions, 13 to 1; violence, 5 to 1.

THE TESTING OF PORTLAND CEMENTS FOR THE HARBOR WORKS OF CALAIS AND BOULOGNE.*

BY F. GUILLAIN.

IN 1884, the French Minister of Public Works established a laboratory for testing Portland cement in Paris, with branches at Boulogne, La Rochelle and Marseilles. As the result of a number of experiments carried out at this laboratory with more than 12,000 briquettes, a specification for the supply and testing of Portland cement has been drawn up, the details of which are given in this paper.

To determine the weight of the cement, only the fine powder is used which has passed through a sieve of 5,000 meshes per square centimetre (32,257 meshes per square inch). This powder is filled into a litre measure (1.76077 pint), with certain precautions which are specified. The weight of one litre of the kind of cement delivered must be within 100 grams (3.5 ozs.) of that of a litre of cement of similar fineness ground in the same manner; but derived from specially selected, heavy clinker from the same factory.

With regard to the chemical test, the cement must not contain more than 1 per cent. of sulphuric acid or sulphides in determinable proportion. Cements containing more than 4 per cent. of ferric oxide, or in which the ratio of the silicate and alumina combined to the lime is less than 0.44, are to be regarded as doubtful. In mixing the mortar for testing, sea-water is specified, and both air and water are to be maintained at a temperature of 15° to 18° Centigrade (59° to 64.4° Fahrenheit) during the continuance of the experiments. The proportion of water to be used must be the same for all tests made on the same day with one and the same kind of cement, and the whole quantity of water must be added at once to the 900 grams (31.7 ozs.) of cement used. The mortar is to be mixed with a trowel for five minutes upon a marble slab. The quantity of water is ascertained by a preliminary experiment, and the four following tests are given to serve as an indication whether the proportion of water added is correct:

1. The consistence of the mortar should not change if it be gauged for an additional period of three minutes after the initial five minutes.

2. A small quantity of the mortar dropped from the trowel upon the marble slab from a height of about 0.50 metre (1.63 foot), should leave the trowel clean, and retain its form approximately without cracking.

3. A small quantity of the mortar worked gently in the hands should be easily molded into a ball, on the surface of which water should appear. When this ball is dropped from a height of 0.50 metre (1.64 foot), it should retain a rounded shape without cracking.

4. If a slightly smaller quantity of water be used, the mortar should be crumbly and crack when dropped upon the slab. On the other hand, the addition of a further quantity of water—1 or 2 per cent. of the weight of the cement—would soften the mortar, rendering it more adhesive, and preventing it from retaining its form when allowed to fall upon the slab. It is recommended to commence with a rather smaller quantity of water than may be ultimately required, and then to make fresh mixings with a slight additional quantity of water.

In order to determine the time of setting of the cement, a portion of it is made into a mortar and filled into a cylindrical box of metal 0.04 metre (1.575 inch) in height, and 0.08 metre (3.15 inches) in diameter. The mortar is then shaken down by a few gentle blows, and the water which rises to the surface is allowed to remain. A needle of 300 grams (10.58 ozs.) weight, and with a square section of 1 square millimetre (0.00155 square inch) is suspended over the box by means of a cord and pulley, and the initial set is considered to have taken place when the needle fails to penetrate the whole depth of the mortar if lowered gently upon it. The cement is said to have set finally when its surface will support the needle. Any cement commencing to set in less than thirty minutes, or setting finally in less than three hours, is to be rejected, and the final set must have taken place within twelve hours. In each case the time is reckoned from the moment the water is poured upon the cement.

The water-test is carried out by making pats or cakes of cement 0.08 to 0.10 metre (3.15 to 3.94 inches) in diameter and 0.02 metre (0.787 inch) thick in the middle, and running out as thin as possible at the edges. These are placed upon pieces of glass and immersed in sea-water at a temperature of from 15° to 18° Cent. (59° to 64.4° Fah.). These samples must show no cracks or bulging. Eighteen briquettes are used for the tensile test, the cement being mixed with a trowel in quantities of 900 grams (31.75 ozs.) at a time, and worked for five minutes before use. The form of the briquettes and the machine for testing them are the same as those used in Germany, the breaking-section being 5 square centimetres (0.775 square inch). The molds are placed upon a marble slab while being filled, and are allowed to remain upon it until the briquettes are perfectly set, when they are removed from the molds, and, after the lapse of twenty-four hours from the time of mixing, are immersed in sea-water, which must be kept at a temperature of 15° to 18° Cent. (59° to 64.4° Fah.) and which is renewed weekly. Six of the briquettes are broken after an interval of seven days, six after twenty-eight days, and the remaining six after eighty-four days.

* Abstracted for the Institution of Civil Engineers from *Nouvelle Annuaire de la Construction*.

The mean of the three highest figures of each series of tests is taken as the tensile strength of the cement under examination. The minimum strength specified for the neat cement in seven days is 20 kilograms per square centimetre (284.5 lbs. per square inch) in twenty-eight days, 35 kilograms per square centimetre (497.8 lbs. per square inch), and at least 45 kilograms per square centimetre (640 lbs. per square inch) in eighty-four days. If, however, the strength in twenty-eight days is not more than 5 kilograms per square centimetre (71.12 lbs. per square inch) in excess of that at seven days, then it must be at least 55 kilograms per square centimetre (782.27 lbs. per square inch) in twenty-eight days, and in any case where this strength is not attained at twenty-eight days it must be exceeded in eighty-four. Tests of cement mixed with sand are also specified. The standard sand is produced by crushing quartzite obtained from quarries near Cherbourg, and sifting it through sieves of 64 and 144 meshes per square centimetre (413 and 928 meshes per square inch). That which remains between these two sieves is washed and dried, and constitutes the standard sand. 375 grams (13.227 ozs.) of this sand is mixed with 125 grams (4.409 ozs.) of cement, and water is added in the proportion of 12 parts by weight to 100 parts of sand and cement combined. The sand and cement are first carefully mixed in a basin or capsule, then the whole of the sea-water is added at once and the mixture stirred with a spatula for five minutes. In filling the molds a small rammer, weighing about 200 grams (7.05 ozs.) is used to beat in the mortar until the water rises to the surface. The excess of mortar is then struck off with a straight knife-edge and the surface smoothed down. When the mass is sufficiently hard the molds are removed, but the briquettes are allowed to remain upon the slabs in a moist atmosphere for twenty-four hours, after which they are immersed in sea-water and treated in the same manner as in the tests with neat cement. At the expiration of the seventh day the strength of the sand-cement briquettes should be at least 8 kilograms per square centimetre (113.78 lbs. per square inch), and in twenty-eight days 15 kilograms per square centimetre (213.35 lbs. per square inch). In twenty-eight days the strength should exceed that at seven days by 2 kilograms per square centimetre (28.45 lbs. per square inch). In eighty-four days the strength must be greater than at twenty-eight days, and at least 18 kilograms per square centimetre (256 lbs. per square inch). The eighty-four-day tests are only considered indispensable for those cements which may not have stood the two previous tests; but if, while the cement is in store, the eighty-four-day tests should be unsatisfactory it may be rejected.

The definition of Portland cement given in this specification strictly excludes so-called puzzuolana cements, or those made of lime mixed with slag. The size of mesh of the sieve is not clearly specified, the thickness of the wire not being stated. The percentage of sulphides in the cement is said to be an indication of adulteration with blast-furnace slag, it being supposed that sulphates only are formed during the burning of Portland cement. The degree of fineness to which the cement must be ground is not specified, it being considered that very fine grinding increases the strength chiefly during the duration of the tests, and that the subsequent increase of strength is less with fine than with coarse cement.

DUST AND ASHES.

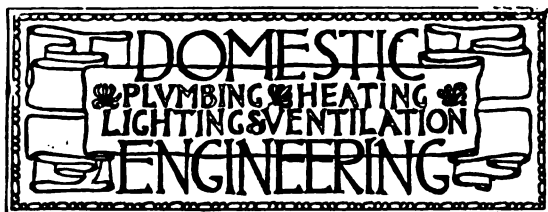
THE *Building News* prints an interesting lecture delivered at Parkes Museum of Hygiene recently by A. F. Fryer, of Wilmslow, on the subject of "Dust and Ashes," from which the following is abstracted:

Some years have elapsed since the problem was presented to the present lecturer—What is an effective method of disposing of the contents of ashpits? It was found on examination that any nitrogenous matter present was so diluted with water and mixed with valueless solids as not to warrant its extraction. In other words, the cost of isolation was in excess of its value, and this was at a time when the salts of ammonia commanded a much higher price in the market than at present. There thus seemed little choice of method; it was necessary to endeavor to reduce the bulk, and, at the same time, render the material inodorous and innocuous by means of fire. There was nothing new in this idea. But the problem how to burn the refuse without offense had not been solved. The most combustible portion of the material consisted of cinder and dust, which had been rejected from countless kitchen and parlor fires as being worthless. It was only needful to experiment with a few shovelful of the material, even in a dry state, in order to extinguish any ordinary fire. It is well known that a small quantity of finely-divided ashes, or of sand, will extinguish a brisk fire. That water has a similar effect is undoubted. It will require no argument to prove that a combustion of fine ashes, cinders, vitrified ashes, or clinker, with an admixture of broken glass and earthenware, and the ever-present provision tins, all sodden with water, was a compound intractable in the extreme. Analysis showed the percentage of water, the percentage of carbon, and the percentage of inert matter. Hydrocarbons were too insignificant to be taken into account. It appeared that in nearly all cases there was more than one-tenth of the weight of water present as carbon, so that the problem admitted of solution on its chemical side. There was, in fact, a sufficiency of combustible material to evaporate the water. The mechanical aspect was less assuring. It would not be enough to drive off the moisture at a low temperature, and to convert the carbon into carbonic oxide and acid. The organic matter must

not be removed by a process of destructive distillation—it must be actually decomposed. The dust which formed no inconsiderable portion of the conglomerate must not be carried up by chimney to be scattered over the face of the country; and as a fierce draught is essential, the difficulty presented was not a trifling one. To state the problem is almost to suggest the mode of its solution. A furnace must be employed. If properly designed and once put into operation, it should be able to generate sufficient heat to effect the evaporation of the liquids and the decomposition of the organic matter. The furnace must be of considerable size, so as to lose as small a proportion of heat as possible by external radiation. The furnace consists essentially of two parts—the grate and the hot hearth. The grate is about five feet square, and separated from the mouth of the furnace by the dead-plate. The furnace-door is of the full width of the furnace, and is balanced, opening outwards and upwards. The grate, unlike that of a steam-boiler, slopes upwards from the door, and at a more steep gradient. The grate-bars being brought into contact with incandescent material are of wrought iron and of special construction; they are grouped and riveted together in sets for mutual support. Being narrow and very deep, they offer only a small surface to absorb heat from the glowing material, but present a large surface for the air to cool as it ascends between adjacent bars. One skeptical individual, distrusting the slender bars supplied by the makers, filled his furnace with ponderous cast-iron bars of square section, but in twenty-four hours after the usual heat was obtained a number of them were melted away. Behind the grate the hot hearth is placed. It is of the same width as the grate, but rises at the back at a more steep gradient. Indeed, cinders placed upon it are at the limit of the angle of repose, and find their way forward on to the grate with only a slight agitation by a poker or hook. The back of the furnace terminates in two openings; one is made for the admission of the material to be treated, and the other for the exit of the products of combustion. The whole of the structure already described is covered by a semi-circular arch, which is placed on an incline, so that its crown is parallel with the grate. This arch is composed of several courses of fire-bricks, and the space between its crown and the level of the first floor or furnace top is filled in with non-conducting material. The arch is destined to receive the radiant heat emitted from the burning material, to prevent its escape and to reradiate it upon the burning mass like a reverberatory arch. It serves also to absorb heat when the fire burns through to the surface of the refuse on the grate, and is bright and clear, and to pay it back when, from recharging with fresh refuse, the surface is dead. There are two other functions which this cavernous arch is expected to discharge. It provides a space highly heated, enclosed by walls, in which the gases can mix and pause, and in which the process of decomposition of the organic matter in the vapors can be completed before they are hurried into the flue. Again, the large space insures a low velocity of the gases, so that much of the dust which would, under less favorable conditions be carried out of the furnace, remains—part to appear as powder after being highly heated, and very much being molten to the condition of slag. The large furnace-mouth permits the withdrawal of cakes of clinker of any size, and the mischievous effect of the admission of large volumes of cold air is checked by the simple device of reducing the outlet at the back of the furnace to the smallest sectional area compatible with efficiency, so that a large door is scarcely more objectionable than a small one. The flue which conveys the products of combustion from the furnace to the chimney resembles a small railway tunnel rather than an ordinary flue. This arrangement presents two advantages. One is that the low velocity of the gases in moving along it permits the deposit of so much of the dust as had passed out of the cells, especially during the process of clinkering; and the other is the facility it gives for the mixture of the gases from the various furnaces, which, fed and clinkered in succession, discharge the gases at different temperatures, by this means giving an assurance that nothing shall enter the chimney unless it has been raised to a high temperature, and maintained at that temperature during a sufficient time to effect complete decomposition. In order to prevent the gases being cooled in the flue, it is placed immediately beneath the furnaces. The chimney is usually from fifty to sixty yards in height. Imagination would fail to marshal the various articles which go to make up the aggregate which is carted to the destructors. Carts laden to the utmost move in a constant stream toward the depot, and where it is practicable they are drawn up to a gently inclining roadway so that their contents can be cast in a closed shed, with galvanized-iron roof, placed above the platform of the furnaces. In contracted places, where the inclined plane is impracticable, the material is hoisted either by means of an elevator or by lifting the bodies of the carts with their contents to the required height, capsizing them, and replacing them on the frames of the vehicles. The upper floor of the furnaces is purposely arranged so as to hold only a few hours' supply of refuse, and thus the only objection which can arise from a properly worked destructor is obviated. If refuse be permitted to accumulate and ferment, it may emit offensive odors, and the proper course is to limit the storage capacity to what is needful to carry on the process without cessation. If removed daily, there is no ground for complaint. Let us, then, imagine a set of cells ready for operation. It is necessary to maintain fires of coal in them until the brick-work becomes hot and dry, and the chimney exerts its full power. Then the refuse is introduced, and coal is never used afterward. Every portion of the refuse

rests in turn on the dry hearth, and the hot gases pass over it on their way to the flue. It is completely desiccated, and portions become red hot. When the portions which have been laying on the grate has been thoroughly burned, it is found that the non-combustible portions have mostly been fused into the form of a large clinker which the stoker withdraws by means of a hook and allows it to fall into an iron barrow or truck. The inclination of the grate favors the operation, and the wide mouth of the furnace offers no obstacle to its removal. The operation is repeated at intervals of two hours. The heated and dried material is readily drawn forward from the hot hearth, and fresh refuse is admitted at the rear. Baskets and bulky, but light, materials are admitted through a large hole left in the crown of one or other of the cells, and closed by a suitable door. The name "mattress-hole" gives some idea of its size and the uses to which it is applied. The weight of the refuse is reduced from four to one, and there is nothing offensive to the senses or in any way objectionable in the gaseous products passed through the chimney, or the solids or clinkers withdrawn from the furnace. The heat generated is often sufficient to burn iron wire, with the emission of brilliant sparks. Glass bottles are fused, and some varieties of pottery likewise melted. Dust and ashes often become slag. The destructor, indeed, fuses everything and refuses nothing. It is not alleged that it is impossible to create a nuisance by means of the destructor. It requires, indeed, very little acuteness to counteract many of the devices which make the operations of the destructor practically perfect. By the simple process of checking the draught, either by allowing the flues to become choked with dust, as by admitting abundance of air at the feeding hoppers, the character of the working becomes radically changed. No longer is the high heat, which decomposes organic matters, maintained, but a low temperature results, which suffices to distill off noxious fumes, without the means of decomposing them. The effect may be increased by suffering the ashpits to become choked with ashes, and thus check the admission of air, and, at the same time, burn the fire-bars away. The introduction of a hole into the side of the chimney is also an ingenious device for producing odor, by lowering the temperature of the combustion. The introduction of holes in the furnace-doors, beyond those which are needed to keep them cool and burn the very small quantity of hydro-carbon present in the refuse, produces a like effect. There is no special care required in tending the destructor. That the heat is intense is evident from the circumstance that, when the gases have passed through the furnace and along the main flue on their way to the chimney, they are usually led through a multitubular boiler, and serve to generate steam at 40 lbs. pressure to the square inch, in quantity sufficient to drive a steam-engine and furnish the power needed to grind the clinkers, mixed with hydrated lime, so as to make mortar, or a sort of concrete suitable for flooring or for walls. When this is done, the whole of the solid matter is utilized. Everything entering the depot possesses a negative value, and everything taken out has attained a positive value. The process is by no means offensive. There is nothing worse met with than the refuse which most people have seen in detail without complaint. After, at most a few hours, it disappears down the throat of the burning fiery furnace, and when it reappears there is nothing of which the most fastidious might complain. The contemplated erection of a furnace for the destruction of refuse matter naturally creates a strong feeling, and often a strenuous opposition among the residents in the locality. The marvel is that the earliest destructors ever were erected. It is frequently of little avail to point to the successful working of the furnaces in many towns. Prejudice in this, as in every other form in which it appears to mankind, is utterly intractable and as well as protean. In most cases, however, the necessities of the place, and the persistence of the authorities, who have first satisfied themselves by careful inspection of other destructors in operation, result in the erection of furnaces; but the ebullition of feeling increases in vigor until they are put to work. The destructor in Whitechapel is placed in the midst of one of the densest-peopled districts in the world. Complaints were grave and frequent, and were scarcely amenable to the argument that whatever might be at fault, at least the destructors were not, as the furnaces were not completed, and consequently not in operation; when, however, the work of the perfect apparatus commenced in earnest, the complaints ceased. The destructors, in which excrementitious matter is burnt, are as inoffensive as those from which it is excluded. The prejudice in both cases is not, however, the same. Indeed, it needs no explanation to the chemist that if the products are raised to a sufficiently high temperature organic matter, as such, must cease to exist.

THROUGH the efforts of Mr. Joseph J. O'Donohue the bill releasing all orphan asylums of New York from water taxation has been signed by Governor Hill. In Brooklyn it will affect six institutions, as follows: Brooklyn Howard (colored), Dean Street, near Troy Avenue; Church Charity Foundation, Albany Avenue, corner Herkimer Street; Hebrew Orphan Asylum, 386 McDonough Street; Protestant Orphan Asylum, Atlantic Avenue, near Kingston; Roman Catholic Orphan Asylum of the Church of the Holy Trinity, and Roman Catholic orphan asylums as follows: St. Joseph's (female), Willoughby Avenue, near Sumner Avenue; St. Paul's (female), Congress, near Clinton Street; St. John's Home (male), St. Mark's Avenue, near Albany; St. Malachi's, Atlantic Avenue, corner Van Sicklen.—*N. Y. World, July 1.*



HOT-WATER CIRCULATION FROM KITCHEN ON TOP FLOOR OF BUILDING.

WE illustrate this week the arrangement of the kitchen boiler and hot-water supply in the rectory 45 East One Hundred and Twenty-ninth Street, New York.

Cold water is supplied to the various fixtures from a rising line of pipe branched from the main supply-pipe in the cellar, so arranged as to be filled by tank or street pressure at pleasure.

For the hot water, the pressure in the street-main is sufficient to raise the water into a small tank on the roof, from which the supply-pipe to the boiler is taken. The kitchen being on the top floor, the usual method of circulation could not be adopted. The boiler was, therefore, made single, and the main hot-water pipe carried from it directly to the ceiling of the basement and then returned to the top floor, where branches were taken out to the various fixtures on that floor. The main hot-water pipe was wrapped with boiler-felt to prevent radiation of heat, and all branches were taken from the rising portion of the line.

Whenever a hot-water faucet is opened, the water passes down the main and up the return to the floor where the draught is occurring. By this means, and by the fact that the kitchen sink is at the end of the line, the supply-pipe is kept full of hot water, which flows as promptly on opening a faucet as with the usual method of circulation.

THE Board of Electrical Control, of New York City, was organized on July 5, by electing Jacob Hess, President, and Theodore Moss, Secretary. This is the reorganized Electric Wire Subway Commission.

A TRIAL of a street-car impelled by an electric motor was made in Philadelphia on June 30. The batteries were manufactured by the Electrical Accumulator Company of New York, and consist of eighty-four cells. The track upon which the car is run is 1,000 feet in length, with four curves, one of which has a radius of thirty-three feet. The exhibition was satisfactory.

THE Julien electric motor for street-cars was tried last week on the Fourth Avenue Surface Railway in this city, with satisfactory results.

LIGHTNING-CONDUCTORS FOR GAS-WORKS.

In January last the chimney of the gas-works at Fécamp was destroyed by lightning; and in consequence of this disaster, a report was obtained from M. Colladon upon the question of the utility of lightning-conductors for buildings in gas-works. The matter was mentioned by M. Debar at the meeting of the French Society of Civil Engineers, and M. Colladon thereupon communicated to the president of the society a statement to the effect that chimneys in gas-works should always be provided with lightning-conductors fitted with powerful tapes for the safe conveyance to earth of heavy charges of electricity. M. Colladon cited cases to prove the disastrous effects of single discharges of electricity upon unprotected structures. He recounts how the destroyed chimney at Fécamp, which was thirty metres high, without a conductor, was built upon a foundation more or less humid from the vicinity of the sea, and containing gas and water mains, which are good conductors of electricity. In the neighbor-

TOWN CONTROL OF NATURAL-GAS.

THE great development of natural-gas enterprises in Ohio has directed unfavorable criticism, says the *Cleveland Leader*, to a law which the State Legislature passed last March, giving to municipalities the right to control the price of gas. It is reported that some enterprises requiring large expenditures of money have been abandoned, for fear of this provision of the law. The text is as follows:

SECTION 1. Be it enacted by the General Assembly of the State of Ohio, that sections 2478 and 2491 as amended April 2, 1880, are so amended as to read as follows:

SEC. 2478. The Council of any city or village in which natural or artificial gas companies, or gas-light and coke companies, may be established, or into which their pipes or mains may be conducted, are hereby empowered to regulate, from time to time, the price which such natural or artificial gas, for lighting or fuel purposes, furnished by such companies to the citizens, public grounds and buildings, streets, lawns, alleys, avenues, wharves, and landing-places; and such natural or artificial gas-light, or gas-light and coke companies, shall, in no event, charge more for any natural or artificial gas furnished to such corporation or individuals than the price specified by ordinance of such Council; and such Council shall also have power to regulate and fix the price which such companies may charge for rent of their meters.

SEC. 2491. A municipal corporation may contract with such company for supplying with natural or artificial gas for the purpose of lighting or heating, the streets, squares, and other public places and buildings in the corporation limits; but this section shall be subject to the restrictions in the last clause of section thirty-five hundred and fifty-one.

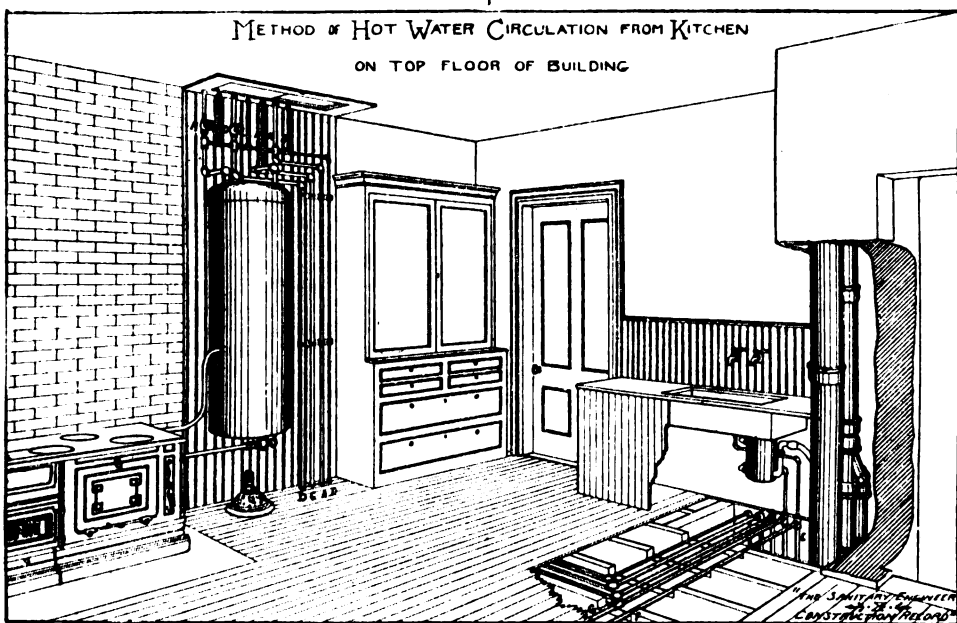
SEC. 2. That section 2478 and section 2491, as amended April 2, 1880, are repealed.

SEC. 3. This act shall take effect and be in force on its passage.

FOOT-VENTS: THEIR LOCATION AND TERMINATION.*

THE regulation of the details of drainage in houses is very important. The great diversity of opinions on this subject has led to no end of discussion. We have of late many popular books on this subject, but the authors do not always agree, and this disagreement gives an impression to some, if not all their readers, that the writers are only half informed after all, and perhaps know but very little more than the balance of us. Their trifling mistakes and omissions can readily be forgiven when regarding the influence they may have in educating the people and awakening public attention and interest to a subject of such vital importance. The only danger is that too implicit reliance may be placed on any such publications as contain all that is known at the time of their publication, or advise the best thing to be done under the circumstances. The fact is this, the whole subject is so new and unexplored that no man has the time to write and publish a book on it, without considerable risk of finding his practice thrown out of date and superseded by some new discovery in physiology or chemistry or some new mechanical device which the army of inventors have contrived while he has been writing. Yet, much good has been done, and can be done, by such publications. No general rule can be laid down for universal application in such matters as the details of drainage and ventilation with any better prospect of success than in the practice of medicine. Within the last generation our houses have changed their character to a very marked degree; not only have their exteriors received artistic development, but their interiors as well. Meantime the introduction of public water-supplies in most of our cities and large towns during the same period has led to the almost universal use of the water-closet in our houses. What was looked upon as a luxury thirty years ago is now regarded as a necessity, and even the cheapest class of houses now have this device. The introduction of waste-pipes for drainage inside our houses, with a constant water-supply, has led to a ramification of the system, and a multiplication of these appliances for the sake of convenience, with too little regard for the risks encountered. In fact, these risks were at first hardly known by any, and if now known do not seem to be understood by many. For this end nothing on the part of the plumber will tend to inspire public confidence so readily and so permanently as the perfect knowledge of his own business and an earnest desire for truth in study as well as in practice. He must show a conscientious faithfulness, and a proper regard for economy in devising the best possible means of reaching the desired ends. If the plumber pursues this course, the public will soon learn to have faith in him as a necessary member in the great social circle, and will heartily contribute to his support. I think all danger arising from sewage gases escaping into the house through unsealed traps can be prevented. The system I would recommend is the placing of a good trap and manhole, well ventilated, at the furthest convenient point from the house; and from the house side of the trap lay two drains, one for the principal sewage and one for the rain-water and waste-pipes from bath and sinks, etc. Another trap and manhole should be placed a few feet from the wall on each of the two principal drains, and these should be ventilated by means of a pipe carried from the manholes to near the smoke-flue, or placed between two smoke-flues, terminating at a chimney-head; this would cause a down current through the soil and waste pipes in

* An essay by J. Giles Smith, Wichita, Kan., read before the National Association of Master Plumbers at the recent annual convention.



EXPLANATION OF DIAGRAM.

- A. Pump-pipe (to be used only in case of loss of pressure in street-main).
- B. Tell-tale.
- C. Hot-water pipe to basement.
- D. Cold-water supply from tank.
- E. Rising hot-water pipe from basement.
- F. Hot-water supply pipe to laundry.
- G. Cold-water supply-pipe to laundry.
- H. Cold-water supply-pipe to boiler.
- I. Air-pipe for same.
- J. Air-pipe for main cold-water supply.
- K. Boiler relief-pipe.

The owner of the property is All Saints' (R. C.) Church. The master plumbers are Messrs. Moody & Bracken, 951 Sixth Avenue, New York. Plans and specifications were prepared by Frederick N. Owen, Sanitary Engineer, 13 William Street.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
July 2.....	27.02	21.52	23.06	31.03	30.02	26.10	30.64

E. G. LOVE, Ph.D., *Gas Examiner.*

hood there were also deposits of coal and coke. It was therefore in a condition to attract lightning; for it is known that soot and tar, such as are found deposited upon the walls of all chimneys, are good conductors. Under such circumstances, therefore, it is particularly desirable that the chimney should be provided with a good lightning-conductor connected to earth with special care. The gas-works at Geneva have a chimney surmounted by a heavy iron cap which terminates in a pointed rod of platinized copper. This rod was in connection with a conducting cable formed of six strands, each of six tinned-iron wires two millimetres in diameter. This cable descended to a depth of three metres below the surface of the ground, where it was doubled in several convolutions, which, even in summer, were immersed two metres in the waters of the Rhone. In July, 1877, however, the point of the conductor was struck and fused by lightning. At a height of 3.5 metres above the ground, a portion of the charge left the conductor and spread along the iron-work of the roof of a shed built against the retort-house wall, after which it pierced this wall, which is sixty centimetres thick, displacing a block of stone in the way to attain the iron gas-pipes which served to light the interior of the retort-house, whereby it finally escaped to earth. Since this event the cable has been supplemented by a better conductor.—*Journal of Gas-Lighting.*

the same direction as the flow of water, etc., in these pipes. Then take a ventilation-pipe off the tail-end of each trap and carry it through the wall, and terminate it at the outside with a hinged grating, and by making the ventilating-pipe the same size as the pipe it ventilates, you will get a supply of air from each grating, following the volume of water as it passes the various branch connections in its descent, which will leave the water in the traps undisturbed, as no actual vacuum can possibly take place with a separate supply of air to the soil-pipe at each floor-level. The gratings in the face of the wall are supply, not exhaust, gratings. Therefore no sewage gases escape near the windows, but are drawn up to the chimney-head by means of the pipe from manholes.

TRADE-SCHOOLS AND TECHNICAL EDUCATION IN THEIR RELATION TO THE PLUMBER OF THE FUTURE.*

It would be futile to endeavor to grasp in its entirety the full scope of the proposed subject within the narrow limits of this paper, and we will therefore discuss, as briefly as may be, some practical ideas which suggest themselves which the members of the National Association may be induced to take into consideration and develop into something that may be of tangible benefit. Trade-schools are no novelty in this age, and yet are not well understood, even among those who may be supposed to possess more than ordinary intelligence and are looking forward in various directions to find a way to solve the problem of the training of the mechanic of the future. Technical education of one kind or another has also occupied a great deal of the attention of educators. As to the somewhat broad distinction existing between the trade-school and the technical school, although the aim and object of each appear to be the same, technical training, in its true sense, means instruction in the use of tools and processes without regard to any particular trade, and is simply used as an adjunct to the ordinary education of the day, thereby instilling into the mind of the youthful student such practical discipline of the hand and eye as is absent from the usual course pursued in our common schools. It is a great pity much of the value of the ordinary education imparted to the multitude of young people who attend school is lost, because it deals so much with abstractions. The schools have taught history, mathematics, language, literature, and the sciences to the utter exclusion of the arts, notwithstanding the obvious fact that it is through the arts alone that other branches of learning touch human life. Every one who looks back to his younger days can call up, without much of an effort, the tedious hours he spent over badly-understood rules of grammar or arithmetic, the prosy details of history or geography, and the many hours spent in copying models of writing, or drudging through dreary formulas of algebra or geometrical problems. And why was this done? Because it was commonly reputed to be the correct way to educate, and there appeared to be no other. It is so still in the vast majority of schools, and apparently will be for a long time to come. Without deprecating a system that at least is hallowed by the customs of bygone generations, it may be permitted to ask, "Could nothing be substituted for it? or could no improvement be made by which more substantial benefits would be obtained than we are now partakers of?" It is conceded that where the two systems are combined—that is, instruction in purely literary subjects, and in technical training—the results have been vastly in favor of the union. The time devoted to any work is not detracting from the value of the mental education, and the reason is plain—that when all the faculties are in exercise they eventually exert a healthy and stimulating effect on each other. Hence, advanced educators, without reference to the mere value of technical training in itself, declare that the benefits of an education are extensively enhanced by the judicious mixture and material support afforded by each in turn, and that the training of the eye and the hand reacts on the brain. Stimulate each to excursions into the realm of scientific discovery in search of facts to apply in practical form at the bench or in a building. The new education is the blending of moral and mental training. It recognizes that science discovers and art outlines, and that these two forces move the modern world. Such being undeniably the case, as evidenced by careful experiment and observation, what a striking commentary is here afforded of the power of musty precedent, when we are still content to plod wearily along in the time-worn ruts of ancestral habits! The dawn, however, is breaking, and efforts are being vigorously made to burst their trammels. The New York Board of Education, as is stated, has appropriated \$50,000 during the present year to test the proper effect of the combined system of education, but considering that the board consists mainly of purely professional men, as distinguished from those directly connected with the practical aspects of our work, it may be premature to expect the largest results from the experiment about being tried. So much for technical education. As already remarked, a distinction exists between technical and what are known as trade schools. While in the former the training is general, as far as the use of tools and methods of work are concerned, in the latter the instruction is specific and has direct reference to some trade in which the learner desires to become proficient. In some of the European capitals great strides have been made in the establishment of trade-schools, where people are taught

all the elementary principles and methods of work, and, having acquired those, are considered to be in the best possible form to be admitted to furnish their apprenticeship in the shops and factories of actual life. It is to be regretted that so far not very extended efforts have been made to establish so commendable and rational a scheme of education in this country. Whatever has been done so far is mainly the outcome of private enterprise and munificence, or is under the honorable auspices of the Philadelphia Association of Master Plumbers, which is presumably the only organization of our trade which has recognized its duty and its privilege in establishing the trade-school. How far successful it has been in results is not known to the general public, and that it would be of the utmost interest to learn goes without saying. The Baltimore and Ohio Railroad Company has also in operation a very complete system of industrial education, and the results obtained have been of the most encouraging and satisfactory character. New York City, as befits the metropolis of the Western world, has not been behindhand in attempts to solve this mighty problem of how the young men of the country shall be promoted to take their place in the ranks of industrial progress. It has been left, however, to the enterprise and benevolence of a well-known citizen in that city to found and equip perhaps one of the completest in design and most practical institutions of that class that has been yet organized. Although yet in its infancy some nine or ten trades, all but one connected with house-building, are practically taught in one session of five months, and the skill and amount of knowledge acquired in that short course have surprised and pleased the practical men who have closely watched the experiment with more or less doubt as to its success. The schools are composed of a series of large buildings covering an area of nearly 20,000 square feet, and are fitted up with every appliance necessary for their complete work. They are not self-sustaining, as is very evident from the nature of the trades carried on there, and the expense is in part sustained by the small admission fee from each pupil and the remainder is borne by the founder. Not taking into consideration the cost of the buildings and land, it is stated on the best authority that these schools have cost some \$30,000 additional, the simple reward for such unprecedented liberality in an untried and experimental field being the knowledge that over one thousand young men have been placed on the road to an independent future. The fame of the school is already national. Young men from the West as far as Denver, Col., from the South as far as Atlanta, Geo., from Montreal and various other parts of the Continent have paid their own traveling and other expenses in order that they might acquire such knowledge as is imparted in this institution. The question here arises,—and (turning to the Chair) you, Mr. President Allison, may be addressed appropriately in relation thereto, as you are known to be in hearty sympathy with the noble cause of industrial education—What can this National Association do to forward it? Philadelphia has already answered by a tongue louder than words. May not the suggestion be permitted that the local associations should put their shoulders to the wheel and endeavor to make a beginning in their respective cities to establish, even on the most modest scale, their trade-school, sustained and engineered by their officers and members? Another suggestion may not be out of place. The expense of board and tuition in New York for a session is something formidable for a young man beginning life. Could not the local association, pending the time of establishing its own school, give a free scholarship to the New York training school, as a prize to excellence in apprentices, and thus stimulate a generous rivalry among them for that distinction? It is not necessary to tell the members of the National Association that there are trying, stirring times for our craft, and that no means should be untried to elevate and promote the welfare of those who will be the mechanics of the future, and it is difficult to perceive how a more unobjectionable and efficient plan could be adopted than that of following the example of the best men in the country in their efforts to raise the standard of mechanical education among our young men. Our trade has been reproached, though unjustly, with having made no well-directed endeavors to sustain and keep filled the ranks of capable workmen. Considering the difficulties inseparable from the mode in which young men acquire the knowledge of the plumbing trade, it should be our anxious care that those difficulties should be diminished and through approved efforts every possible agency for the good work should be pressed into service. While perhaps not exactly pertinent to the subject, it may not be amiss to advert to the excellent system of apprenticeship of the city in which this convention has the honor of being held. This system, if faithfully carried out, and supplemented by some preliminary education in a trade-school, possesses advantages far in advance of any legal or compulsory apprenticeship that has ever been devised. The one is young, full of promise and consonant with the spirit of the age; the other is worn out, inconsistent with manly self-respect, and wholly inadequate to its purposes and should be relegated to the dust of the tomb with other works of bygone ages. It is the purpose of the association of New York to complete the work it has been engaged in during the past year, waging its battle for the boys and carrying out to its full extent the system above alluded to. That it had taken no previous action during the lifetime of the association may perhaps be explained by the difficulty of sufficiently arousing the conscience and intelligence of men already overburdened with the cares of business. The crisis passed through, however, must be sufficient to prove that we must be on the alert, not only to meet and confront danger, but, as wise and discreet men are the

cause of discontent and thus brighten the path of the plumber of the future.

SECOND ANNUAL REPORT OF THE BOARD OF HEALTH OF THE CITY OF NEWARK, N. J., for the year 1886. 61 pp., 8vo. Newark. 1887.

This report is prepared by Dr. David L. Wallace, the Health Officer of the city and Secretary of the Board, and is of special interest at the present time in connection with the question of the pollution of the Passaic River. Dr. Wallace reiterates the statement made in his previous report, that the water-supply of Newark is polluted, and that the city of Newark and points below its intake are responsible for two-thirds of the pollution. He thinks that the remedy is to improve the present supply rather than to obtain a new supply from the head-waters of the Passaic, and suggests that filtration with aeration and the compelling manufacturers and communities along the line of the river to subject their sewage to such a degree of purification as will return the effluent water to the river with at least fifty per cent. of its organic impurities removed will accomplish all that is needed.

In many sections of the city there are no sewers, and even where these have been constructed privy-vaults are the rule rather than the exception, being connected with the sewers by overflow-pipes without traps, which is about the worst possible arrangement that can be devised. Dr. Wallace advises that "an ordinance should be passed requiring that all leaching privy-vaults and cesspools should be abolished on premises abutting in streets in which sewers are laid." If the word "leaching" were omitted from this sentence, it would be good advice, but as it is, it does not touch the chief evil—viz., that of tight vaults having overflows to the sewer, and which are constantly delivering putrid sewage. So long as this is allowed it is impossible to keep the sewers in satisfactory condition.

Good work has been done in carrying out a system of house-to-house inspections. There have been 11,757 houses inspected, in which 1,844 nuisances were found. Defective plumbing and drainage was found in 1,037 cases, or in nearly ten per cent.; 1,129 private wells were found connected with these premises. Bearing in mind the number of leaky cesspools and privy-vaults in the city, it is a question whether the water from these wells or that from the Passaic is the most dangerous.

The total number of deaths reported for the year was 3,602. The population is estimated at 160,319, which gives an annual death-rate of 22.5 per 1,000. While this is at least 3 per 1,000 higher than it ought to be—that is to say, while between four and five hundred of these deaths were due to defective sanitation and were unnecessary—the wonder is that the death-rate was not greater. It is certainly time that Newark set seriously to work to get rid of its privy-vaults and cesspools, to complete its sewerage, and to secure a water-supply fit for use by a civilized community.

ALBANY WATER-SUPPLY IN 1686.

MUCH has been spoken, written, and printed in this city, during the past ten years, concerning the nature and purity of Albany's water-supply. Long and earnest have been the discussions in the Common Council and by the water commissioners, health officers, city physicians, and others on this topic, yet nothing that they have set forth against the impurity of the old city wells, the condition of Tivoli Lake and environs, or of the potable qualities of the Hudson River water, can go to establish that the Albanians of to day have a more impure aqueous supply than did their forefathers of two centuries ago. For at a meeting of the Common Council of the city, "held ye 6th day of November, 1686," the following minute and resolution was adopted to cure an already existing evil:

"Whereas, there hath been divers orders published from time to time concerning ye wells and fountains of ye city where sundry people rinse their clothes, throw down water and all sorts of filth neer to ye sd wells and water their horses out of ye pales yt hangs at ye same and draw water with foule pales; it is therefore ordered, by ye mayor, recorder, aldermen, and commonalty of ye city, yt no person whatsoever shall for ye future rinse clothes, throw water or any sort of filth in or neer any of ye wells or fountains within this city, nor water their horses out of ye pales yt hang at ye same, or draw water with any foule or dirty pale, upon pain of forfeiture of ye sum of 12s. for each offense; one moyety thereof to ye mayor, aldermen, and commonalty of ye city & ye oyr moyety ye use of ye sheriff, constable or any oyr person as shall inform or sue for ye same."

The only effect that this ancient ordinance seems to have had, judging from the happenings of this year of grace, was to teach a better code of etiquette to the quadrupeds, for it may well be doubted if now a horse can be found in the city that will drink from a filthy pail.—*Albany Argus.*

* An essay prepared by the New York delegation, and read before the National Association of Master Plumbers at the recent annual convention.

THE ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

HOTEL KAATERSKILL IN THE CATSKILL MOUNTAINS, }
July 7, 1887.

LAST Thursday evening, at an informal meeting at the house of the society in New York, arrangements were completed for our trip hither on the following day (July 1). We left the city Friday morning by the Day Line steamers on the Hudson River for Rhinebeck, the landing, where we were to be transferred to the cars through the valleys of the Catskills. We had on board a majority of our members and guests. At Rhinebeck we crossed the Hudson by ferry and took a special train on the Ulster and Delaware Railroad to Phoenicia, the connecting point with the Stony Clove and Catskill Mountain Railroad. From Phoenicia this narrow-gauge railroad carried us through the grand scenery of the Stony Clove and the valleys or gorges between Phoenicia and the Hotel Kaaterskill. The railroad is in part built on the mountain side with only a few feet between the rails and the precipitous descent. Hundreds of feet below lay the valleys. Through this region we traveled in open observation cars giving us a fine view of its beauty. We arrived at Kaaterskill station in the early evening, and were conveyed to the hotel in stages.

Arrived there, the members were gathered on the grand plateau in front of the hotel, and Mr. William G. Hamilton, Chairman of the Committee on the Convention, presented the following address of welcome:

Ladies and gentlemen and guests, members of the American Society of Civil Engineers. On behalf of the Committee of Arrangements I welcome you to your new home for the coming week.

We have safely passed over the stormy Tappen Zee; skirted the passes of West Point, bristling with cannon; piloted with skill the shores of the Dundenberg, and climbed the mighty ascent of the Appalachian chain.

Creation is before you. Liberty guards the portals of the Hudson—the engineers the summit of the Catskills. Our Surveying Corps reports that we are safe, though encircled by "dears."

Your flag of possession will float over your heads as a token of our mastery of the situation.

In the study of your profession and in the search of the known and unknown take squatter sovereignty of the glades and glens. In your visits to the woodlands let the trees and rocks be the only confidants of your philosophical discourse.

When treading the rustic paths or crossing the mountain streams go two by two of assorted sexes, so that you can fully appreciate the proportions of the Cantilever system, or can't-I-lover form.

Luna, at our request, being full of light, will beam on you with loving rays. Later on we will have learned practical treatises on Poughkeepsie bridges, which, we trust, will not prove Bridges of Sighs.

We hope to treat you to a feast of reason and a flow of soul, where the learning and eloquence of our brethren and sisters will cast new glory on our society, and pass to posterity sweet memories of this our Nineteenth Annual Convention.

In welcoming you to this beautiful spot we hope, laying aside all cares of the outside world, we may worship Nature in all its loveliness and in close communion.

To sustain you in this arduous task forget not to partake liberally and with punctuality of the viands which will be hourly set before you. To revive your spirits let not engineering qualms act as a bar against the search of mixed quantities and potentials. Lean upon each other with disimulation; assist each other in treading the winding ways or scaling the giddy heights.

Hoping that your committee may, in all things, warrant your approval, and that this meeting may be cemented by bonds of stronger friendship, and that your flag may long wave over the deliberations of this, one of the most enlightened and cultivated scientific bodies in our proud Republic, I bid you welcome in the name of our committee.

"Unfurl the flag and pass the loving cup."

The emblem of the society—a white flag with their coat-of-arms in the centre—was unfurled, after which the members sang an original composition, entitled, "Salute to the Flag." All hands then formed a circle, and the wassail cup was passed around.

The words of the song were as follows:

SALUTE TO THE FLAG.

First on this mountain height our flag floats to the skies,
And as its colors rise above us, let their hue
Be symbol of that honest faith and life we prize,
And of the earnest work we ever strive to do.

No symbol this of war, nor yet of strife with man;
But badge of vict'ries won o'er Nature and its powers;
Helping by thoughtful art the world to better plan,
Proud that such noble work fills all our busy hours.

After singing and the wassail bowl, supper followed, at which each lady was presented with a bouquet of flowers and the compliments of the society.

JULY 2.

The convention was organized at 10 A. M. by the appointment of T. C. Clarke, M. Am. Soc. C. E., of New York, as chairman.

The first papers read were discussion on the "Inspection and Maintenance of Railway Structures," which continued until nearly half-past one.

Some time previous to the meeting of this convention the following "suggestions" were sent to members supposed to be familiar with them:

What measures, legal or other, can be taken to insure a proper inspection of railway bridges?

What is proper bridge inspection?

Should there not be a standard specified rolling load much heavier than as now generally used, and a specified engine wheel base for rolling loads?

Is it not expedient to adopt a standard bridge floor?

Should not bridges of small span be made strong enough for a buckle-plate floor, and a continuous coat of ballast on the bridge, and if so, up to what span should this apply?

Should not a safety guard (Latimer) be used at all openings over a certain width?

Should there not be required, either overhead crossings, or, in their place, interlocking apparatus with derauling switches?

Is legislation as to any of these points, or as to any others you may suggest, expedient, and if so, what sort of legislation?

In this connection the experience of the Master Car Builders' Association has been referred to, which, it is stated, has proved that the action of large committees reporting to the society, and the adoption of standards after ample discussion, have been found very valuable.

The first paper read on this subject was by John A. Wilson, of Philadelphia, the title being "Maintenance and Inspection of Railway Structures," and read by the Secretary.

He stated that the engineer in charge of bridges should have full detailed plans of the structure with strain sheet and calculations showing what load the bridge will carry with safety, personally making a critical examination at least once a year, and oftener if necessary. A competent master mechanic should make an examination once a month giving a detailed report to the engineer in charge. The road foreman and watchman should make daily examinations, reporting promptly any defects discovered. Each railroad should establish a standard for its own line, high enough to cover all contingencies and conform their bridges thereto. His objection to grade crossings were "danger to life and property, delays to traffic, and expense of operating." Separation of grade crossings should be made wherever practicable.

The next was a paper by Willard S. Pope of the Detroit Bridge and Iron Works, and read by Mr. Hamilton. He favored a State Commission, composed of civil engineers, and appointed by the officers of the railroad companies on account of their large acquaintance with engineers. All plans of new structures should be submitted to them. "Bridge inspection to be efficient must be done intelligently. To the trained eye its defects if any are patent. Bridge wisdom is peculiarly a specialty. It comes only by patient study and long training."

The fourth paper was by Charles A. Marshall, Engineer of Tests, Cambria Iron Co., Johnstown, Pa., and read by Mr. Wiley. The writer advocated a commission appointed annually by the State composed of expert engineers, some members holding over. The duties of this commission should be to examine and license inspectors. The licenses should be of three different grades:

1. As to materials.
2. As to fabrication.
3. As to compliance with general strength.

These inspectors should pay a moderate annual license fee, and it should be a penal offense after a specified lapse of time to build certain classes of structures without securing their services.

The fifth paper, by Albert Lucius, New York, was read by Mr. Wellington. This writer preferred a floor of closely laid ties on iron stringers, the latter spaced sufficiently far apart to give the floor a certain small amount of elasticity, to a floor under a buckle plate and ballasted.

The sixth paper was by Andrew Bryson, New York, and read by Mr. Croes. He would compel the railway companies, by legislative act, to either keep in their employ competent men to inspect their bridges, or have an inspection made at least once a year by a competent outside engineer, and to furnish strain-sheets and detailed drawings to the Commission. There should be a standard specified rolling-load much greater than is now used, and a specific wheel base for rolling-loads. This standard should be prescribed according to the nature of traffic.

As to bridge floors, "It seems to me that if the width and strength of floors were specified the manner of meeting these requirements could be left to individual designers."

The next paper was by E. P. Dawley, Engineer of the New York, Providence, and Boston Railroad, and read by the Secretary.

"It is doubtless pretty well agreed among engineers that 3,000 pounds per lineal foot of track is not enough for spans 100 feet and less to discount future service. This road has used for several years past a rolling load of 3,000 pounds per lineal foot of each track; the dead load per floor being 500 pounds per lineal foot. Strains allowed the same as Erie's specifications. The following is the standard floor used: Hard pine timbers 8'x9'x26', supported below in case of a through bridge by seven stringers per double track, timbers being laid flatwise, fifteen inches between centres. A guard timber 8x9 inches outside of each track, and a third one half way between tracks. Guard-rails running to a point in centre of each track, and continued across bridges seven inches from main rail. Guard timbers at ends of bridges arranged as per Child's plan for the Latimer safety-guard."

The next paper in this discussion was by Samuel T. Wagner on "Inspectors and Bridge-Work," and read by the author.

"Inspection may be divided into two distinct classes—First, those that know what they want and know when

they have it; Second, those that do not know what they want, and therefore are at a loss to decide when they have it.

"Manufacturers may also be divided into two classes—First, those that intend to give good work, who have a reputation at stake and value it; Second, those who will resort to underhand dealings in order to pass off work, and whose object is to make money at the expense of their reputation." He recommends that all material that has been accepted from the mills should be stamped by the inspector, and also every finished accepted member. A naturally suspicious inspector will be a source of needless worry to all around him, while one free from it, and possessed with an ordinary amount of common sense and intelligence, can get good work without making needless trouble, even if his technical knowledge is small. Assuming that all iron for a bridge has been rolled, tested, and inspected for surface defects, straightened, etc., and delivered to the shops, a question then arises, "What inspection should be made as the work progresses? This may be again divided into three parts—

First.—Riveted Members: Floor beams, stringers, chords, and end members; interior parts, struts, pedestals, and wall plates.

Second.—Forgings: Eye-bars, upset and eye-rods, clevises, and other blacksmith work.

Third.—Machine Work: Pins, rollers, turned bolts, etc.

It seems to be a disputed point whether the careful measurements usually made with a steel tape are necessary. For the finer measurements required in bridge work, the author uses for the purpose of checking to within one-eighth of an inch standard steel poles which are shop standards. This closed the written discussion, but the discussion was continued by calling on members known to have had long experience. Don J. Whittemore, a past president of the society and chief engineer of the Chicago, Milwaukee and St. Paul Railroad, was the first speaker.

He stated that he had been connected with this road for twenty-two years. That this company now controls 5,400 miles of railroads, 2,500 miles being acquired by purchase, and in this system there were 110 miles of bridges to be watched. There was also 12,000 culverts, which were designated by odd numbers, and the bridges by even numbers.

A book account was kept for each, giving date examined and condition; and when repairs are made a detailed account is given with cost. After twenty-two years of this careful attention to the structures on this road there has not been a single failure under a normal condition of service. The political engineer should never be appointed on a commission. Whenever he informed the directors that anything required attention the order would be to attend to it at once. If all roads having fair financial standing would follow this example accidents would be reduced to a minimum.

Mr. Theodore Cooper, of New York, an expert in bridge construction, was the next speaker. He stated that the danger of poor inspection was not with the first-class roads, but with those without responsible owners—with the latter the law should deal sharply. A theoretical and a practical man should examine every part of the structure. Inspection should be made on the bridge itself and not in the office. The young man sent out to be an inspector should be an old man. He preferred an outside guard-rail and a high one.

There are roads that object to high guard-rails, as they interfere with the snow-plough, when it will only cost them fifty dollars to change one to pass over a high guard-rail. Inspectors should be appointed. Every man should be held criminally responsible until they can show that a responsible person has been placed in charge. Criminal responsibility should begin at the top. The society as a body is not competent to decide a bridge question, but should be confined to the decision of experts only.

Edward S. Philbrick's paper was read by Mr. Croes. He stated that a State Board of Commissioners should be authorized to employ experts to examine and report upon the sufficiency of plans, etc.

Proper bridge inspection should include an examination of strain sheets, an examination of every member, and a search for any signs of depreciation. Prudence would make it necessary to anticipate probable future increase of weight of the rolling stock.

For all trunk lines a standard rolling load and wheel load, with axle distances for locomotives, could and should be adopted. A standard should be adopted for bridge-floors. Bridges with buckle-plate floors and continuous ballast afford the advantage of a more smooth and noiseless track and greater security from derailment, but are not to be recommended on account of concealed defect of rust.

Level crossings should not be allowed unless protected by interlocking signal.

Mr. Wellington read a paper prepared by J. M. Goodwin, of Sharpsville, Pa.

"The Ashtabula bridge was inspected periodically from the time of its erection up to the collapse, but this inspector looked with unappreciating eyes at conditions which, had he possessed the knowledge of a bridge specialist of the present day, would have induced him to carefully place himself outside of the bridge. The inspector was a boss carpenter. A 'cursory' inspection is one made from the rear platform of a running train." He favors the Latimer safety guard.

Stanley H. Goodwin, General Superintendent Lehigh Valley Railroad, stated that inspection of railroads should be controlled by the State government and not the

National. The inspection should include county bridges as well as railroad.

Mr. A. M. Wellington stated that "bridges should be built strong enough so as not to need inspection. The tendency of automatic coupling and train-brakes is to increase weight of train loads so that bridges will have to sustain more, and that will be an increase in the cost."

Mr. Roberts—"Inspection should begin as soon as contract is signed and continued to completion of the bridge."

Mr. C. C. Schneider, designer of the Niagara Cantilever bridge, thought that the best inspectors frequently were required to take a back seat.

Mr. Allen and Frederick Graff, Past President, also joined in the discussion.

Wm. Kent stated that the American Society of Mechanical Engineers appointed two committees of experts, one on standard pipe threads and the other on standard boiler tests, and since their reports were made a majority of the manufacturers have adopted them; he thought that the appointment of a committee on Bridge Inspection by the American Society of Civil Engineers would have a similar influence.

Robert I. Sloan, Chief Engineer of Manhattan R. R. Co., gave a description of the system of inspecting the elevated road in New York. The organization is as follows: One chief engineer and two assistant engineers who have charge of all construction and maintenance, which includes foundations, buildings, coal and water stations, tracks, track signals, and interlocking apparatus; one roadmaster, one assistant roadmaster, and one night roadmaster; four supervisors, one for each road; under each supervisor is a structure foreman in charge of a gang of men, who are employed either on construction or maintenance. The structure foreman has men who examine the rivets and trusses and have a section to go over every day.

There are also gangs employed on the track in charge of foremen: One on Second Avenue, two on Third Avenue, two on Sixth Avenue, and one on Ninth Avenue. There are fifty painters, who are required to report anything they may discover. There is also a street gang which attends to all foundations, and repairs of sidewalks.

The foremen report to the supervisors, supervisors report to roadmaster every night at South Ferry all defects found in structure or track. The roadmaster reports to the chief engineer every morning at 10 A. M. everything done the previous day or that has occurred. An expert engineer is also employed, who makes a personal examination every month, reporting monthly to the chief engineer. The chief engineer goes over a portion of the road daily. The description given by Mr. Sloan was interesting, as showing the apparently thorough inspection of the New York elevated railroad structures.

A paper was also read by J. M. Wilson, of Philadelphia. It was nearly 14 o'clock, or 2 P. M., when the morning session adjourned to meet at 16 o'clock.

At the afternoon session the first paper was by a German engineer who gave a description of his system for treating sewage with hot water to destroy all disease germs; his process was considered expensive for general application, costing two marks per cubic metre of sewage.

The next paper was a description of the "Operation and Results of a Single Expansion Steam-Engine Supplemented by the Evaporation and Expansion of the Bi-Sulphide of Carbon and its Vapors," by Charles H. Haswell, of New York, and read by the Secretary. He gave a description of the plant and a detailed account of experiments made. The writer's conclusions were: "Reviewing the elements submitted it is presented that by the use of the vapor of bi-sulphide of carbon in the vessel connected to an ordinary steam-boiler and engine it greatly exceeds both in pressure and volume the steam that generates it, and it is an evident and infallible consequent that an increase in power and economy of fuel is obtained with a less number of boilers and consequent wear."

Discussion followed on steel tapes and steel rods for use in bridge measurements, which was opened by J. B. Johnson, Professor of Civil Engineering, Washington University, St. Louis, Mo. He preferred the steel tape and thought that more accuracy could be obtained than by the use of steel rods. Mr. Wagner replied by stating that the expansion of a steel tape was greater than rods, being more quickly affected by changes of temperature, and the divisions on the tape are not sharp enough for accuracy. Professor Johnson's reply was that the University possessed a steel tape three hundred feet long which had become a standard. To illustrate, he stated that a base line had been measured near the Missouri River, the details of which are given in current reports of the War Department, which was measured four times with an error of only one in 1,000,000, and the difference in two measurements showed an error of only one in 3,000,000. Three thermometers were used, and the work was done on densely cloudy days. In reply to Mr. Flagg, he stated that there was but little difference between the expansion of steel and iron—for steel 0.000055, and for iron 0.000070.

To Mr. Collingwood's question, "How is the tape preserved?" he stated that it was wound on a reel eight inches in diameter; the width of tape was one-eighth of an inch, and area of section one two-hundredths.

One speaker thought the objection was in the great number of steel tapes necessary to contend with, and Mr. Croes replied by stating that this could be remedied by the manufacturer supplying the inspectors with a standard.

A member stated that he had much success in the use of rods made of black walnut, which had been treated by boiling in oil, but Mr. Johnson thought they would not do for extreme accuracy.

At 18 o'clock the afternoon session adjourned until 20:30 o'clock. Before the meeting adjourned Mr. W. G. Hamilton made the following announcement: Mr. President, at a meeting of the sister engineers of the society some solicitude (perhaps jealousy) was expressed at the white-hairedness, or bald-headedness, of the President and Past-President from too much brain-power, and feeling perhaps it might extend to the members generally (the committee, of course, being excepted), I ask permission to read the following communication:

"The engineers who have been cultivating their heads during the day are invited to meet in the ball-room immediately after the evening adjournment for the purpose of cultivating their heels, to thus maintain a balance of intellect. The ladies (who need no cultivating) are expected to be present to act as guard-rails to keep the members on the track. By order of the switch-tenders."

The following were appointed a committee of the exercises: President Worthen, Mr. Haskins, and Mr. Oberlin Smith.

The President's address was given in the evening, after which a "hop" was held.

JULY 4

A session was held to-day between 10:30 and 14 o'clock. The first paper read was a description of the locomotive "De Witt Clinton," by G. H. Thompson, engineer of bridges, N. Y. C. & H. R. R. The locomotive described was the third engine built by West Point Foundry Association, of New York City. The first engine (the Best Friend) exploded; the second engine was a failure; the De Witt Clinton a success.

The first passenger train of America was drawn by this locomotive August 31, 1831, over the Mohawk and Hudson R. R. (now the N. Y. C. & H. R. R.) from Lydia Street Depot, Albany, to Schenectady, seventeen miles distant. At Albany the ascent from Hudson River to Lydia Street was made by an inclined plane. The De Witt Clinton left Lydia Street in good condition, and continued the up-grade trip to a point half way from Albany, when she stopped. The line, which had thus far been straight, deflected at this point three-quarters of a degree; curves not being known then, she stopped to turn the angle, then proceeded to Schenectady in about one hour after leaving Albany. The engineer was David Matthews, a man still living and over 90 years old.

This paper contained a copy of a letter written by him, dated July 2, 1885, with date of trial and description of locomotive. A photograph of a drawing made of this locomotive by L. P. Hannas was presented with it. Mr. Matthews, in his letter, states that he "left North Moore Street, New York City, and was experimenting and fitting up tender, governor, and training him on the track till the 9th day of August, 1831, when I took the colt and gave the old boys a ride behind him over the hills to the Mohawk."

The chairman of the Committee on Compression of Cements, F. Collingwood, then made a report, which produced much discussion, on the manner of treating cement. D. J. Whittemore, Past President, stated that he had made about 1,500 tests on fourteen different brands of cement selected from both the East and West. These experiments showed that neat cements have less ultimate strength than when sand is added. Cement having low tensile strength will have increased ultimate strength when sand is added. He had used cement when the mercury was 2° above zero in building the pier of a drawbridge, the mortar freezing as built, but when the sun thawed the cement on southerly side it settled three-fourths of an inch. In about four months after, the frost came out of the north side, which settled to the same level, and pier is now in good condition. Mr. Collingwood and Mr. Worthen gave some experience. Mr. Noyes, Construction Engineer on Champlain Canal, stated that some experiments he made with a cement made in this state developed greatest strength when sand was added 1 to 1. Discussed by William J. McAlpine, F. C. Prindle, J. F. Flagg, J. Bogart, C. Tompkins, E. P. North, E. Kuichling, E. P. Clarke, P. P. Dickinson, and B. F. Church. A summary of the experience developed by this discussion would indicate that cement when frozen after being used, and exposed to the action of the sun, is affected, that its ultimate strength is weakened by the use of smooth sand, but increased by the use of sharp sand, whether fine or coarse, if thoroughly mixed. General Greene thought that no risk should be taken with frozen mortar in important work.

The next paper was a detailed description of the construction of Poughkeepsie Bridge by J. F. O'Rourke, engineer in charge of construction for Union Bridge Company. Sections and plans were presented. The paper was of much interest and designed to make the construction more easily understood to-morrow when a visit is to be made to it, having received a special invitation from the Union Bridge Company. The meeting adjourned until Wednesday.

In the afternoon a special business meeting was held for the purpose of raising a building improvement fund to be devoted to the improvement of the societies house in New York City, or to erect a building better adapted to the requirements of the society on some other site. It was decided to build an addition on the rear of the present building. A subscription was started and in less than an hour \$5,025 was raised.

In the evening the members attended a ball in the parlors of the hotel.

JULY 5.

A large number of the members left the Hotel Kaaterskill in the morning to visit the Poughkeepsie Bridge. They were taken from Roundout on boats provided by the Union Bridge Company to the bridge. Every portion of the bridge accessible was examined by them, and all were bountifully supplied with refreshments before returning, which was late in the evening. The members who remained at the hotel witnessed a severe mountain storm. The forenoon was misty, followed in the afternoon by a severe storm of both rain and wind. Only a little rain was seen by the members visiting the bridge.

Sessions were held on Wednesday and Thursday. At 9:30 on Thursday evening a banquet was served, covers being laid for 1,300 persons. Mr. W. G. Hamilton presided, and at 11 o'clock the first toast was given. The toasts were as follows: "The President of our Society, William E. Worthen, whose Happy Management of the Society is Crowning it with Laurels; Our Past President, General George S. Green, the Pioneer in Engineering," responded to by the Hon. W. J. McAlpine; "The Bright Side of Engineering," D. J. Whittemore; "Hydraulics," Frederick Graff; "The American Society of Civil Engineers," Theodore Cooper; "The Engineering Press," A. M. Wellington; "The Water-Supply of New York," B. S. Church; "Technical Education," R. E. McMath; "Our Sister Societies," J. F. Lewis; "Our Southern Members," J. Cohen; "Our State Improvements," John Bogart; "Our Foreign Guests," Henri Oesinger; "Our Treasurer," J. J. R. Croes; "The Ladies," Oberlin Smith.

During the course of the evening a display of fireworks was given under the direction of Pain & Son, of London, England. Among the set pieces was a locomotive crossing a trestle, which was fully appreciated. On Friday the members will visit the cement works of F. O. Norton.

[The report of the proceedings will be continued and completed in our next issue.]

IRON AND STEEL ANGLE-BARS.

Iron, in its report of the eighteenth annual meeting of the Iron and Steel Institute of Great Britain, which began on May 26, prints, among other things, an interesting and lengthy paper by Sir Bernhard Samuelson, entitled "Notes on the Terni Steel Works."

Mr. Samuelson, in speaking of a paper read before this body some time ago on the "Use of Steel in Naval Construction" by Sir Nathaniel Barnaby, then director of Naval Construction to the Admiralty, in which he drew attention to a peculiarity in steel angle-bars which distinguishes them from iron—i. e., when the end of a steel bar is cut off roughly and is left ragged, the leaves break off suddenly if struck heavily; whereas the other end of same bar, trimmed off evenly, will bear heavy sledging without rupture. Mr. Samuelson then goes on as follows:

"A rather startling case showing this liability to cracking or tearing across of steel came under my notice within the last week or two. A firm who purchased rolled steel from us recently ordered a quantity of bars 1½-inch in diameter of soft steel. The bars were rolled down in our works in the usual way from ingots 13 inches square, containing 0.14 per cent. of carbon. The parties purchasing the steel required them for colliery-tub axles, and in the course of manufacture they were cut into about 2-foot lengths, the two ends being drawn down in the smith's fire to one inch square for about three inches long to take the boss of the wheel. After smithing they were laid on a flat plate and generally straightened with a few light blows from a hammer. And now please mark what happened. A number of the axles broke in two, like a piece of glass. Naturally, a complaint was made to us that we had supplied steel of irregular quality. We felt certain that the quality was good, but went carefully to work to trace out the fault. In the first place we analyzed the broken pieces. This showed steel of good quality, there being nothing whatever abnormal about it, the carbon being 0.14 per cent. as intended. We then tried bending the pieces which had flown off on attempting to straighten the axles, and found that, without exception, they bent end to end without showing the slightest symptom of failure, and worked perfectly in the smith's fire, there being no sign of red-shortness; they also welded as usual. The cold fracture gave exactly the appearance which would be expected from steel of the temper indicated. On further investigating the matter, it was found that the whole of the fractured pieces could be bent round cold until the two ends touched, without the slightest indication of failure. It was evidently not that a few defective bars had been sent out in the bulk, but it was noticed that two axles from every bar failed. The matter became apparently more and more perplexing.

"Now for the elucidation of the mystery. By a very close examination of the surface of the bar at the point of frac-

ture, it was noticed that there appeared to be on one side a small portion filed across the bar. The whole of the fractures had taken place at this filed portion, and on no other portion of the bar was there any appearance of filing. Further investigation showed the fact to be that, whereas the bars were ordered without any brand upon them, the rollers at the mill had carelessly neglected their instructions, and had branded each bar in the usual way near each end. Having afterwards observed their mistake, they had slightly hammered down the surface of the bar, with the view of obliterating the brand, and then they had very slightly filed the surface where hammered across the bar. Every bar could be broken off short with the greatest ease by a blow or two in the vicinity of this filing. When an attempt was made to bend the bar with the filed portion on the outside of the bend, it always failed; but if the defaced brand was on the inside of the bend, no difficulty was experienced in making a close bend. And please note this further. When the defaced surface was heated and swaged slightly to obliterate the filing, and again slightly filled longitudinally, the bending could equally well be effected with the defaced portion on the outside of the bend. This experience was rather a startling one, as showing how sensitive a bar, or a piece of a homogeneous material like steel, is to a tearing action, if only a means of starting the tear exists. In this case, the slight nick or crack for the commencement of the tear was provided apparently by the defaced brands and scratches from the tooth of the file, the jarring or vibration from the hammering providing the further tearing action."

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

THE CONVENTION SEASON.

ELMIRA, N. Y., July 4, 1887.

SIR: Have just read your editorial on conventions. Though agreeing with you in the main, that the social feature is made too much of and that the "interchange of experiences" in the meetings does not take place, still ideas are suggested there, which are discussed by members after the meeting, and the interchange of experience does take place there, but does not get into the published pro-

This view will show you the method by which it was done. The pipe was lowered into the river by screws, which are too small to be seen in this photograph.

You will notice that the pipe vertically is an irregular line, being approximately the contour of the river-bed on which it was to lie. The trestles are rough horses, similar to those used by carpenters or plasterers. In the St. Joseph River the deepest water was 4 feet, and the current about three miles an hour. The horses were set and held by two men each. Then the 6x6 stick laid on them and a pipe rolled out to hold all in place. When the pipes were placed lengthwise of the trestles they were supported by 2x4's laid flat, enough being put under to support the pipe. The frame was immediately built over the pipe and the pipe slung in wire slings from the hook below the screw. When all was in place across the river the pipe was lifted from the 2x4's and lowered as Mr. Coates describes in his paper.

If you should publish this cut it is so near that described by Mr. Coates, I think your readers would better understand Mr. Coates' description.

Mr. Coates was in Elkhart one or more times in 1884.

We had used this method at New Castle, Pa., two years previous to this, but we never supposed it a sufficient novelty to write a description of it.

Yours very truly, J. H. HARLOW & Co.

AN ELECTRIC YACHT.

NEWBURG, June 23.—At a shipyard here there is being constructed the first vessel to be propelled by electricity ever built in the United States. It is a yacht 37 feet long, 7 feet wide, and 5 feet deep. It is to be run by stored electricity. It is building for a Newark (N. J.) electric company, and will run between that city and New York. Vessels of this kind have been built in England, but never before in the United States.—*New York Herald*.

THE Rapid Transit Commission of New York City has refused to allow the proposed additional elevated railway routes place their "loop" on the Battery.

THE Water-Board of Newark, N. J., has ordered an investigation into the charges of mismanagement against the board which have been made in the press.

DEATH OF JACKSON BAILEY.

JACKSON BAILEY, editor and one of the founders of the *American Machinist*, died at his home in Brooklyn, N. Y., Thursday, July 7, in the forty-first year of his age.

Born at Schenectady, N. Y., May 12, 1847, Mr. Bailey enlisted as a private in the 134th Regiment of New York Infantry at the age of fifteen, and served three years to the close of the war. He was at Missionary Ridge and in several other battles, and served in Sherman's army during the march to the sea.

Mustered out of service at eighteen years of age, he graduated from the State Normal School at Albany, N. Y., and afterward was engaged in teaching. Later on he connected himself with a New York publishing firm, which position he relinquished to become New York representative of the *American Manufacturer and Iron World*, of Pittsburgh.

In November, 1877, he joined Horace B. Miller, under the firm name of Miller & Bailey, in establishing the *American Machinist*. The paper was successful from the start, and Mr. Bailey retained his connection with it up to the time of his death, though his failing health during the past two years had, during a considerable portion of that time, rendered him unable to do active work. His disease was of malarial origin and developed into consumption of the bowels. He leaves a widow, but no children.

At the time of his death Mr. Bailey was First Vice-President of the New York Press Club and a member of a number of engineering societies.

Mr. Bailey was a high-minded, conscientious man who won the esteem and confidence of those who came in contact with him.

PERSONAL.

MAYOR HEWITT, of this city, has appointed Peter B. Olney, General Louis Fitzgerald, Stevenson Towle, Thomas C. Clark, and James B. Smith Rapid Transit Commissioners to lay out new routes in accordance with a petition of householders, which was filed in the Mayor's office May 30.

THE death is reported by cable of General Ruhard, Chief Engineer of the French Ministry of War.

P. E. LE FEVRE, U. S. N., has been appointed Superintending Engineer of the Ocean Steamship Company, with station in New York City.

MAYOR HEWITT has appointed Dr. Joseph D. Bryant as Health Commissioner of New York City. Dr. Bryant was born in Wisconsin about forty-two years ago, and was educated in Norwich, Conn., afterwards graduating from Bellevue Hospital Medical College.

Dr. Bryant was appointed Sanitary Inspector in the New York City Health Department in 1873; resigning after six years' of service to accept the professorship of surgery at Bellevue Hospital Medical College, which position he still holds. Dr. Bryant is also Surgeon-General on Governor Hill's staff.

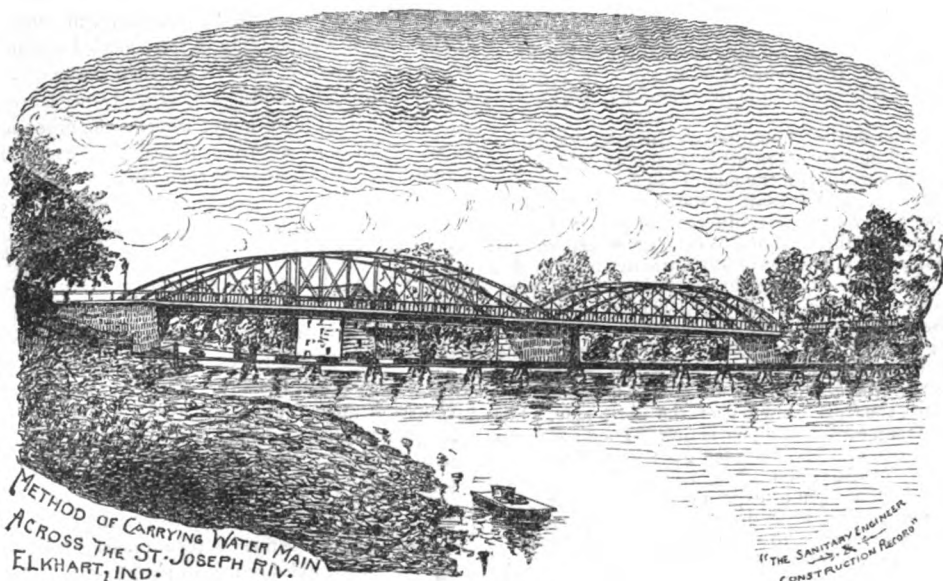
PAST ASSISTANT ENGINEER JOHN A. TOBIN, U. S. N., has been appointed by the President Superintendent of the Building for State, War, and Navy Departments in Washington.

CAPTAIN SAMUEL P. GRIFFIN, formerly of the U. S. Navy, and for some years past superintending a contract on the Panama Canal, died at Aspinwall, on the Isthmus, July 4, aged 61 years.

CHRISTIAN E. DETMOLD, architect and engineer of the Crystal Palace in New York, died in this city July 9, aged 78 years. Mr. Detmold was originally a railroad engineer, and built the Charleston and Hamburg Railroad in South Carolina, one of the earliest railroads in this country.

MR. GEORGE S. RICE, M. Am. Soc. C. E., has been appointed Deputy Chief Engineer to the Croton Aqueduct Commission of this city. Mr. Rice is at present a resident of Boston. He was at one time connected with the Lowell Water-Works, and since 1881 has been a mining engineer in Colorado and Arizona. Mr. Rice was also connected with the Boston Main Drainage Works.

THE death of Franklin Cook, C. E., a member of the Engineers' Club of Minneapolis, is reported.



ceedings. I account for this on the ground that these men are mostly practical men, who are unused to expressing their ideas in public meetings, but who, in gatherings outside the regular sessions, can and do impart a great deal of valuable information.

To those who rely on the published reports, I suggest a trial attendance on one of the annual conventions, with every confidence that they will feel amply repaid, not only in the rest and enjoyment, but also in actual information received. This has been my experience.

Yours truly,

A MEMBER AM. WATER-WORKS ASSN.

[We did not intend to convey the impression drawn by our correspondent from the article referred to, and we do not think it can be so interpreted.—Ed.]

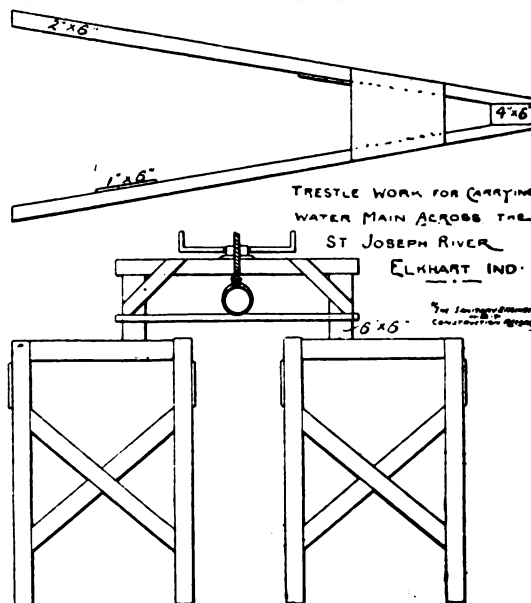
CARRYING WATER-MAINS ACROSS A RIVER.

JAMES H. HARLOW & Co.,

Engineers and Contractors,

411 WOOD STREET, PITTSBURG, June 23, 1887.

SIR: In your issue of June 18, I see an article by W. R. Coates, on "Carrying Water-Mains across a River." Enclosed please find photographic view of 12-inch pipe laid across the St. Joseph River, at Elkhart, Ind., in the summer of 1884, by George R. Harlow.



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

J. L. Bass, of Rome, Geo., solicits correspondence with architects with a view to obtaining specifications and estimates for a new hotel for which \$100,000 has been raised.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 146-147-148.

WATER, SEWERAGE, ETC.

TUSCALOOSA, ALA.—The American Water-Works and Guarantee Company, of Pittsburgh, Pa., will make a proposition for the building of works here.

ALBANY, GEO.—Address J. G. Stephen in regard to the company which will build water-works and a street railroad here.

FLORENCE, ALA.—The American Water-Works and Guarantee Company, of Pittsburgh, Pa., have made propositions to construct water-works here.

MECHANICSTOWN, MD.—The Mechanicstown Water Company will build the water-works here.

GOWANDA, N. Y.—Bassett Bros. and Hardicke & Ware are contractors for reservoir and pipe. Both firms are from Buffalo.

NEW HARTFORD, N. Y.—The question of obtaining water-works is again discussed here.

FINDLAY, O., will vote, July 19, on the question of establishing water-works.

AUSTIN, MINN., has voted in favor of building water-works; estimated cost, \$25,000. Mayor French can give further information.

NORTH PLATTE, NEB.—Plans for water-works are being prepared.

BIRD CITY, KAN., has voted in favor of establishing water-works.

THOMASVILLE, GEO.—C. H. Williams will receive proposals for constructing a water-tower seventy feet high, with iron tank 25'x30' on top.

EDEN, ME.—Town meeting, June 30, voted to raise \$60,000 to complete the sewerage system.

DOWNS, KAN., has voted to raise \$30,000 of bonds for water-works.

EAST OAKLAND.—The Contra Costa Water Company will build two reservoirs.

CRETE, NEB.—See our Proposal Column for water-works here.

CHARLES CITY, IOWA.—Bids for the construction of water-works here will be opened July 20. A. A. Richardson, of Lincoln, Neb., is the consulting engineer.

VALPARAISO, NEB.—Proposals for building water-works will be opened July 30. Plans are by A. A. Richardson, C. E., of Lincoln, Neb.

YORKVILLE, ILL.—The contract for water-works has been let to George C. Morgan. The works are to be completed by November 1.

BRANTFORD, ONT., is looking for sources of water-supply.

KINGSTON, ONT.—The city has bought the works of the company at \$120,000.

AUSTIN, MINN.—Town meeting has voted in favor of expending \$25,000 on a water-works plant.

TRENTON, N. J., is preparing to construct some large sewers. A hearing will be held July 19.

GREENSBORO, N. C., wants proposals for water-works.

GRAND RAPIDS, MICH., is agitating for additional water-supply, including more water mains.

PLYMOUTH, MASS., will replace 2-inch iron mains with 4-inch.

CARBY, O.—Our correspondent writes: "There is no movement in the line of water-works as yet—at least nothing positive. There was some talk, but the matter has dropped."

LOS ANGELES, CAL.—The Pacific Water Company has been incorporated at Los Angeles by H. H. Markham, of Pasadena; F. L. Raymond, of San Gabriel; N. Vandervliet, of Santa Ana; L. W. Dennis, C. H. Bradley, of Los Angeles. The company will acquire water rights, etc., and sell water in the San Gabriel Valley, or the San Pascual or Santa Anita Ranches.

LEWISTON, ILL.—A town meeting has voted in favor of putting in water-works; also of electric-lights.

LITTLE FALLS, N. Y.—A dam will be built at the upper end of Loomis Island. Stephen E. Babcock is in charge.

MACON, GEO.—The city has made a contract with the Macon Gas and Water Company for two years for a supply of water.

VAN BUREN, ARK.—The Water and Light Company, of St. Louis, has made a contract to build water-works here.

MEMPHIS, TENN.—Organized is the Artesian Water Company; R. C. Graves, President; John J. Welles, Secretary.

WASHINGTON, GEO.—has a bill before the State Legislature providing for the raising of \$10,000 to build water-works.

MACON, GEO.—The Central City Water-Works Company has a bill for articles of incorporation before the State Legislature.

MILLEGAVILLE, GEO.—Water-works will be built here. Address Samuel Walker.

TUSCALOOSA, ALA.—Address the Tuscaloosa Coal, Iron, and Gas Company about water-works.

PAINESVILLE, O.—Address H. P. Sanford, City Engineer, in regard to sewers.

SOUTH WILLIAMSPORT, PA., will have water-works on plans by W. R. Coates, C. E., of Kalamazoo, Mich.

COLUMBIA, MO., will build water-works after plans by W. R. Coates, C. E., of Kalamazoo, Mich.

HAMILTON, O.—The National Water-Supply Company, of Cincinnati, has contracted to put in a set of driven wells at \$9,000.

RUSHFORD, MINN., will have water-works.

HUDSON, WIS.—Water-works will be built; \$20,000 have been raised for them.

BUTTE, MONT.—The Silver Bow Water Company will build works here.

MALDEN, MASS.—Plans are being prepared for a high-service water-supply.

ENGLEWOOD, N. J.—This evening the recently incorporated Englewood Sewerage Company will complete its organization by the election of officers and directors. The capital stock is \$50,000, of which \$20,000 is already paid in. The purpose of the company is to provide sewerage for Englewood; its charter also allowing the company to carry out the drainage of wet lands. The number of stockholders is about 85, nearly all of whom are residents of Englewood. Among them are Jacob S. Wetmore, Donald McKay, R. H. Rochester, and George W. Betts. The plans for the work are not yet decided upon, and will not be until the engineer is selected to design them, but it is expected that about five miles of pipe-sewers will be laid. The discharge will be in Peck Creek, a tidal way branch of the Hackensack River. It is expected that work will begin in the fall. The sewers being owned by a private company, it is presumed that a charge, *pro rata*, of the value of the property, will be made for connection with them. A water-supply system constructed by the Hackensack Water Company (reorganized), which furnishes the water, will be completed by September 1, which will necessitate the speedy introduction of sewerage.

WELLSVILLE, O.—A report on sewerage will be made by Surveyor George.

COVINGTON, KY.—The trustees of the water-works decline to make public the bids for constructing a reservoir.

PETERSBURG, ILL.—At a special election held July 2, it was decided to issue bonds to the amount of \$18,000 for the construction of city water-works.

KAUKAUNA, WIS., is receiving propositions for the building of water-works.

READING, PA.—The Water Board recommends to City Council an appropriation of funds to purchase two Hyatt filters with a capacity of 1,000,000 gallons of water daily.

MANKATO, MINN.—F. S. Blodgett, Consulting Engineer, has approved the plans already made for a sewerage system. City Council have not yet definitely voted, and meantime the Lowell system has been presented to their consideration.

SANTA FE, N. M.—The Rio Grande Land Company, of this city, is a new incorporation, backed by the Atchison, Topeka and Santa Fe Railroad Company, to construct irrigating canals, develop towns, construct water and gas works, etc. H. L. Waldo, of Santa Fe, is President; A. S. Johnson, of Topeka, Kan., is Secretary.

GENEVA, N. Y.—The Water-Works Company has decided to purchase new pumping engines having a capacity of 2,000,000 gallons daily.

ST. CLOUD, MINN.—There is a proposition to sell the water-works of the city.

DULUTH.—The gas and water company have just begun the past week improvements to cost \$125,000.

LITTLE FALLS, MINN.—A special election results in overwhelming vote favoring extensive improvements in the water-power at this point.

WEST HOBOKEN, N. J.—Bids for sewers were opened by Town Council July 6, but no action was taken. The total cost is estimated at \$67,000. The individual bids were not given out.

LOS ANGELES, CAL.—The Pacific Water Company has been incorporated at Los Angeles by H. H. Markham, L. W. Dennis, Nelson Vandervliet, C. H. Bradley.

SANTA BARBARA, CAL.—The Santa Barbara Water, Land and Cinnabar Company has been incorporated by D. H. Jones, George W. Miller, E. J. Ryan, S. P. Platt, M. H. Gibson.

BRIDGETON, N. J.—City Council has approved the contract with J. H. Haines, of Cape May, for sinking a well at the water-works to cost \$4,000.

GRAND RAPIDS, MICH.—Hydraulic Company will build a steel stand-pipe, 30x100 feet.

ALBANY, N. Y.—The contract with Andrews Bros., of New York, for a daily supply of 10,000,000 gallons of water at \$237,000, has been ratified.

SYRACUSE.—Turner, Clark & Rawson, of Boston, are organizing a company to submit a proposition to the city for furnishing a supply of water. They propose to take the water from the east branch of the Salmon River.

BIRMINGHAM, ALA.—City Engineer Carter is advertising for proposals for a brick sewer about one mile in length, and requiring 3,000,000 bricks.

RALEIGH, N. C., asks for correspondence with C. G. Lalla, Chairman of the Committee of Aldermen on Sewerage, on the subject of constructing a sewerage system.

SHANEAULES, N. Y.—The Shaneteles Water-Works Company, on July 5, was granted, at a special meeting of the Board of Trustees, a franchise for laying mains and supplying the village with water. The conditions are that the works shall be in operation within two years from December next, and that the company shall not charge the village more than \$40 a year for every hydrant used by the village, and that the company shall not sell the franchise to any non-residents of the village.

PROVIDENCE, R. I.—The Board of Public Works will obtain plans and specifications for a reservoir on Fruit Hill, to cost about \$50,000.

PORTSMOUTH, VA., is still receiving propositions from water projectors.

MT. HOLLY, N. J., is taking steps to obtain better water.

SANFORD, FLORIDA.—The Water Company will put in new pumping machinery and lay larger mains. The cost of improvements will be about \$75,000.

DALLAS, TEXAS.—The Oak Cliff Water-Supply Company has been chartered with a capital of \$50,000. For information address T. L. Marsalis and Thomas Field.

WEATHERFORD, TEXAS, and Pochontas, Va., are reported as wanting water-works.

SANTA ANA.—A syndicate has been formed to supply the city with water.

NEWBURG, N. Y.—The City Engineer advertises until July 19 for proposals for a 15-inch sewer.

CHESTER, PA.—On July 7 the formal transfer of the South Ward Water-Works to the Chester Water Company was made, which will complete the plant as soon as possible. Reservoirs will be built on Harrison's Hill.

LANCASTER, PA.—On July 6 Councils received a supplementary report from J. J. R. Croes, M. Am. Soc. C. E., of New York City, on improving the water-supply, presenting two plans, costing \$79,131 and \$81,131, respectively.

HIAWATHA, KAN.—This town is now putting in water-works. J. F. Grimes will give information of the progress of the work, etc.

HANOVER, N. H.—On July 6 the Special Water Committee reported in favor of introducing a gravity system of water-supply at a cost of \$35,000. They were instructed to confer with the authorities of Dartmouth College, to ascertain what share of the expense the college will bear, and then to secure legislation necessary to undertake the scheme.

GERMANTOWN, MASS.—Twelve-inch iron pipe will be laid to furnish water-supply to this suburb of Boston.

WHITMAN, MASS.—The town will hold a special town meeting to decide upon the purchase of pumping-engines and water-mains for the new water-supply.

MALDEN, MASS.—The Mayor and Aldermen are prospecting for sources of water-supply. Bear's Hill, in Reading, is proposed, the cost of reservoir and mains being estimated at \$350,000.

GAS, STEAM, BUILDINGS, ETC.

FAIRMOUNT, W. VA.—Address H. S. Sands about an electric-light plant to be erected here.

KNOXVILLE, TENN.—R. N. Hood and others have formed a company to bore for natural-gas.

MACON, GEO.—Incorporated is the Consumers' Gas-Light Company of this city; Jesse W. Starr, of Philadelphia, H. H. Horne, T. J. Carling, S. Weichsellaw, of Macon, incorporators; capital \$125,000. New works will be built.

INCORPORATIONS IN NEW HAMPSHIRE.—Among the bills which have passed the State Legislature are the following: Act to incorporate the White Mountain Telephone Company; act to amend an act to incorporate Dover Gas-Light Company; act in amendment of an act to incorporate Keene Gas-Light Company.

HYDE PARK, ILL.—Incorporated is the Hyde Park Electric Light Company; capital, \$250,000; Hugo Hofman, Louis Schwab, George N. W. Clark incorporators.

SAN FRANCISCO, CAL.—Incorporated is the Natural Gas and Mineral Development Company; J. B. Southard, F. W. Bean, David McClure, and others incorporators.

HUNTSVILLE, MO., wants proposals for sinking a well. Address W. T. Rutherford.

CHICAGO.—Incorporated is the Chicago Natural-Gas, Fuel, and Light Company; incorporators, Charles Goodwin, John G. Schurz, R. A. Wade, A. H. Armour, John T. Nichols, S. R. Burke, and George C. Armstrong.

CHICAGO.—A city ordinance is under consideration, which authorizes the Commissioner of Public Works to advertise for electric lights for the river front.

CHICAGO.—The city has decided to purchase the necessary plant for electric lights on the bridges.

OAKLAND, CAL.—Articles of incorporation have been filed at Oakland, of the Roe Electric System Company, with Julius Jacobs, A. P. Brayton, J. H. Roe, George C. Perkins, and William Alfor as directors. The capital stock is \$100,000.

LYONS, N. Y.—The Thomson-Houston Electric-Light Company will erect a plant for lighting this town.

ERIE, PA.—Organized is the Presque Isle Natural-Gas Company; J. F. Downing, M. Griswold, W. A. Galbraith, and others, directors.

AUSTIN, TEXAS.—The City Water Company and the Austin Electric-Light Company have consolidated under the name of Austin Water, Light, and Power Company. The electric-light plant will be enlarged.

SHERMAN, TEX.—The Sherman Electric Light and Power Co. will enlarge its plant.

RAILROADS, BRIDGES, CANALS.

BRIDGE CONTRACTS.—The Berlin, Conn., Bridge Co. has been awarded the contract to build an iron bridge across Little River at Seymour.

Baker & Pittman, of Thomasville, Geo., have been awarded the contract for the bridging of the South Florida and Georgia Railroad.

The Detroit Bridge Company has been awarded the contract to build an iron bridge over the Scioto River at Chillicothe, O.

RAILROADS.—The Arizona Valley Street Railroad Co., of Los Angeles, Cal., has been incorporated; J. S. Phillips, J. F. Humphreys, C. H. Ward, and Eugene Riggins.

The Great Bend, Water Valley and Western Railroad Company, of Great Bend, Kan., has been incorporated; C. W. McDonald, Concordia; Ira Lloyd, Ellsworth; A. M. Lasley, Lyons; G. W. Nimocks and others.

The Red Cloud, Kirwin and South-western Railroad Company, of Kirwin, Kan., has been incorporated; D. Dodge, H. Moulton, W. T. Belford, M. H. Johnson and others.

The Garfield, Pawnee Valley and Colorado Railroad Company, of Topeka, Kan., has been incorporated; G. W. Nimocks, D. N. Heizer, Great Bend; A. J. Hoisington, Garden City; R. M. Spivey, Newton; and P. D. Terry, Terrytown, incorporators.

RAILROAD.—The Pittsburg, Baxter Springs, and Galveston Railway Company has been incorporated at Baxter Springs, Kan., to build a railroad from Pittsburg, Tex., to Baxter. Charles M. Daniels, John M. Cooper, and others are directors. The capital stock is \$250,000.

RAILROADS.—Bills will be introduced in the Georgia State Legislature to charter the Augusta, Thomasville and Gulf Railroad Company, and the Augusta, Gibson and Sandersville Railroad Company.

RAILROAD.—The Nashville, Florence, and Sheffield Railroad Company is taking measures to raise money for completing the line. A meeting will be held at Columbia, Tenn., July 25. M. H. Smith is President.

WELLINGTON, KAN.—Eastern capitalists have made an agreement with the local officers of the Fort Smith, Wellington and North-western Railroad to build roads. Bonds have been voted from Arkansas City to Russell, Kan., aggregating \$724,000. John Murphy is president of the road.

MARYSVILLE, KAN.—Marysville township has voted \$30,000 in bonds to the Chicago, Omaha and South-western Railroad. Richland Township has voted \$20,000, and Waterville township the same. This insures the building of the road. Work will commence at Marysville within sixty days.

ST. JOSEPH, MO.—The Wyatt Park Railway Company has been incorporated with \$500,000 capital. The incorporators are business men of this city and Holt, Andrews, Atchison, and Nowaday counties. The line will be four miles long, and be run from the central portion of the city to the Wyatt park, southeast of the city.

CONCORD, N. H.—It is proposed to extend the line of the Dover, N. H., and Winnisseeogee Railroad to Lake Village and Laconia.

DES MOINES, IOWA.—The Southside Viaduct Company has been incorporated to build viaducts; C. L. Watrous is president.

LINCOLN, NEB.—Articles of incorporation of the Lincoln and Black Hills Railroad Company have been filed in the office of the Secretary of State. The principal place of transacting business will be at Central City, Neb. The company was incorporated by G. Holdridge, president, and J. G. Taylor, secretary.

MILWAUKEE, WIS.—The capital stock of the Milwaukee Cable Railway Company, \$300,000, has been subscribed and the following officers elected: President, F. E. Hinkley; Vice-President, J. A. Hiney; Secretary and Treasurer, R. E. Graves; H. W. McNeill, manager; Directors, John A. Hiney, William P. McLaren, F. E. Hinkley, H. W. McNeill, and R. E. Graves. Work will soon begin.

ALEXANDRIA, LA.—The Louisiana and Arkansas Railroad will be built soon.

BRIDGES.—The contract for building two highway bridges at Almonte, Ontario, Canada, have been awarded to George Bradford, for the masonry work, \$6,480, and to the Dominion Bridge Company, for the iron work, \$10,945.50.

COLUMBUS, O.—The contract for an iron bridge over the Scioto River, at this place, has been given to the Columbus Bridge Company at \$21,000. It has a span of 2,060 feet.

RAILROADS.—Incorporated at Springfield, Ill., are Richards' Elevated Railway Company, of Chicago, to construct elevated railways in the city of Chicago and adjacent territory, the same to be operated by steam, electric, cable, or other power; incorporators, Harry A. Richards, John J. Healy, and Frederick Ahlschlaeger. Also the South Chicago and West Shore Railroad Company. It is proposed to build the railway from some point in Section 5, Township 37, N. R. 15, east, third P. M., in Cook County, Ill., in a south-westerly direction to Dalton, in the same county, with a branch from some point in Section 19 to Hegewisch. The principal business office is to be in Chicago. The following residents of Hyde Park are the incorporators, and also the first Board of Directors: George W. Spencer, John B. Warren, Gideon L. Barber, Frederick W. Green, and George Willard.

PLATTSBURG, N. Y.—It is expected that the Chateaugay Railroad will be extended twenty miles to the lower Saranac Falls.

KEOKUK, IOWA.—The Atchison, Topeka, and Santa Fe Railroad will be extended to this city. The city will purchase the right of way. Freight and passenger depots will be built, to cost about \$20,000.

BRIDGE.—The plans of George W. Catt, Bridge Engineer of the San Francisco Bridge Company, have been accepted by the Illinois Central, for a \$2,000,000 bridge across the Ohio River at Cairo, Ill.

PALATKA, FLA.—Address Col. S. B. Cyster in regard to a railroad bridge to be constructed near here.

ALBION, ORG.—George C. Morrison is engineer of the bridge which is to be built here.

WINNIPEG.—The contract for the construction of the Red River Valley Railroad from Winnipeg to Pembina was signed June 30, and work will commence at once.

JERSEY CITY, N. J.—The Committee on Bridges will have plans and specifications prepared for an iron bridge over the Morris Canal at Claremont.

NEW YORK CITY.—The Park Commissioners have decided to fill in the low ground at Eighty-sixth and Eighty-seventh Streets on the Riverside Drive. The engineers' estimate of cost is \$36,000.

MILWAUKEE, WIS.—The Milwaukee and Northern R. Co., June 30, let the contract for building ten miles of railroad from Republic to the Champion mine to Harrison & Green. The work will be begun at once and completed this fall.

DETROIT, MICH.—Address the Michigan Central Railroad, at this city, in regard to the proposed bridge at Fort Street which the city desires built.

BIRMINGHAM, ALA.—The engineers are at work laying out the line of the Birmingham and Atlantic Railroad. Dr. J. A. West is manager.

SPRINGFIELD, ILL.—Articles of incorporation were recorded in the office of the Secretary of State June 30 of the Chicago and State Line Railroad Company. It is proposed to run a railroad from a point on the line between the States of Indiana and Illinois at the intersection of the New York, Chicago and St. Louis Railway Company to the city of Chicago. The principal business office will be at Chicago. The Board of Directors are as follows: William K. Vanderbilt, James A. Roosevelt, and John S. Kennedy, of New York; John Newell, A. G. Amesden, P. S. Blodgett, Pliny B. Smith, and N. A. Skinner, of Chicago.

LEBANON, PA.—It is reported that Robert A. Coleman, of Cornwall, Pa., will construct a railroad from Lebanon to Reading, twenty-eight miles, at a cost of about \$1,000,000.

THOMASVILLE, GEO.—Engineers are surveying the line of the Thomasville and Tallahassee Railroad. Contracts for grading will soon be made.

FINDLAY, O.—Incorporated is the New York, Mahoning and Western Railroad, of Findlay. The road is to run from Youngstown to Van Wert. The incorporators are Ben Le Fevre, O. P. Rony, L. M. Schwan, E. R. Chapman, C. W. Haskell, W. I. Reed, and W. W. Sutton.

RAILROAD INCORPORATIONS.—The Cincinnati Burnet Woods, Clifton and Cummins Street Railroad Company, Cincinnati, O.; Thomas Morrison and others, incorporators.

The Clay Center City Railway Company, Clay Center, Kan.; George F. Parmelee, and others, incorporators.

The Muncie City Railway Company, Muncie, Ind.; W. W. Ball and others, incorporators.

The Third Street Railroad Company, Newburg, N. Y.; Cornelius L. Waring and others, incorporators.

The St. Paul, Minn., Belt Railroad Company; Edmund Rice and others, incorporators.

The Chattanooga, Tenn., Southern Railway Company; W. Crutcher and others, incorporators.

HELENA, MONT.—The Butte and Ruby Valley Railroad Company has been incorporated by H. Elling, William W. Morris, A. J. Davis, H. Knowles, D. McCranor, S. Ward, W. A. Clark. Capital stock, \$1,000,000.

OSHKOSH, WIS.—There is a proposition under discussion looking to the construction of a boulevard along the lake shore, at a cost of \$100,000.

COUNCIL BLUFFS, IOWA.—The Council Bluffs and Omaha Wagon Bridge Company will build a bridge over the Mississippi River.

WASHINGTON, D. C.—Colonel Peter C. Hains will soon advertise for proposals for constructing the bridge across the eastern branch of the Potomac River. The cost will be about \$100,000.

PORTLAND, ORE.—The Portland Cable Road Company has been incorporated at Portland by T. G. Murphy, A. W. Wright, Jr., J. C. McCaffery, Joseph B. Thompson. A road is to be built to Portland Heights.

LOS ANGELES, CAL.—The Los Angeles County Railroad Company has been incorporated by M. L. Weeks, R. C. Shaw, O. C. Rounds, J. S. Miller, E. C. Burlingham. The road will be from Los Angeles to the Pacific Ocean at the Bay of Santa Monica, a distance of twenty-eight miles.

RAILROAD. Address Dr. Oille, of St. Catharines, Ont., in regard to the Niagara Central Railroad.

BOSTON.—The Bridge Commissioners will advertise for proposals for stone-work for the Harrow Bridge, about July 14.

ST. PAUL.—The South St. Paul Rapid Transit Company have closed a contract with the Daft Electric Light Company, of New York, to furnish the electric plant for their proposed line of road. Mr. B. F. Hamilton, chief engineer of the Enos Electric Railway Company, is in the city and will superintend the construction.

MINNEAPOLIS, MINN.—The Minnesota Belt Line Railway and Transfer Company has filed articles of incorporation. The incorporators are: W. D. Washburn, R. B. Langdon, L. E. Fletcher, John Crosby, W. S. King, George A. Brackett, J. S. Pillsbury, and W. H. Eustis. The capital stock of the company is \$1,000,000.

BIDS OPENED.

CLEVELAND, O.—Bids for the Union Mills school-house have been rejected. Bids will be accepted and

contracts made for the 16-room building on Scranton and Viga Avenues: Mason work, Kirkheim & Schenk, \$15,946; cut stone, John Barclay, \$4,950; carpenter work, John Rochford, \$14,025; lath and plaster, Thomas Tarbet, \$1,875; galvanized iron work, C. W. Steon, \$950.52; iron work, T. H. Brooks & Co., \$354.20; painting, M. T. Polcar, \$1,037; slating, Auld & Conger, \$2,224; heating, Isaac D. Smead & Co., \$5,700; plumbing, Paine & Henderson, \$24,950; sewer, Clements Brothers, \$1,444; total, \$50,652.02.

CHICAGO, ILL.—Bids were opened July 1 for building a crib-work around the lake-crib. The bids were as follows: O. B. Green & Co., \$153,079; Fitzsimons & Connell, \$147,794 and \$143,394; and H. B. Herr & Co., \$126,246. No award was made, and the probabilities are in favor of the "improvement" being abandoned on account of cost.

COLUMBUS, O.—The City Civil Engineer has awarded contracts to N. B. Abbott for laying a West Virginia fire-clay brick pavement on Fourth Street from Town Street to Naghten Street.

DETROIT, MICH.—The Board of Public Works has received the following bids for constructing a bridge over the Detroit River from the mainland to Belle Isle Park: King Iron and Bridge Manufacturing Company, Cleveland, \$350,000; Milwaukee B. & I. Works, Milwaukee, \$287,000; Mt. Vernon Bridge Company, Mt. Vernon, O., \$281,000; Detroit B. & I. Works, Detroit, \$280,000.

NEW YORK CITY.—Bids were opened as follows at the Department of Docks on Friday, July 1, for preparing and building a crib-work bulkhead at the foot of East 76th Street, East River: John D. Gillis, \$35,000; W. Danforth, \$48,066.

BROOKLYN.—On July 5 the Board of Education opened bids for heating apparatus in certain schools as follows:

Rutler & Blake, two boilers for the Lafayette Avenue school, \$1,472; two boilers for the Butler Street and Vanderbilt Avenue school, \$1,472; boilers for the Wilson Street school, No. 16, \$828; two upright boilers for the Lafayette Avenue school, \$1,067; two upright boilers for the Butler Street and Vanderbilt Avenue school, \$1,067; upright boilers for the Wilson Street school, No. 16, \$684; for heating and ventilating apparatus for school No. 16, \$5,932; for heating and ventilating apparatus for the Butler Street and Vanderbilt Avenue school, \$6,486. The bids were referred to the Committee on Heating and Ventilating for examination and report.

Chairman Harkness, of the School-house Committee, reported the receipt of but one proposal for an iron stairway for the Patchen Avenue school, that of Poulson & Eger, \$1,738. On motion the bid was rejected on the ground that there had been no competition and the committee ordered to "advertise for proposals."

ST. PAUL.—The Court-house Commission has opened the following bids for work on the new court-house: Plastering: James Cullen, \$23,549; James Wilson, \$16,775; Oliver J. Firth & Co., \$25,785; Norris & Reaney, \$32,700; Doyle & Beattie, \$18,956; George Hanley, \$28,775; Matt Breen, \$34,000; Joseph Eastman, \$21,747; M. H. Ward & Co., \$10,581; J. P. Adamson & Co., \$9,600; Prendergast Bros., \$13,500; P. V. Dwyer & Bros., \$11,500; Hudner & Regelsberger, \$10,975.

Fire-proofing: Minnesota Terra Cotta Lumber Co., \$32,443; Gregg & Griswold, \$25,950; Matt Breen, \$27,500; Pioneer Fire-Proofing Co., \$32,000; Western Fire-Proofing Co., \$39,500; Wright Fire-Proofing Co., \$33,900.

PHILADELPHIA.—Bids have been opened at the Survey Department for the construction of main and branch sewers. The bids for the main sewers were as follows: For a continuation of the Mill Creek sewer along Meadow Street, 20 feet in diameter: W. H. H. Achuff, \$62; James Deehan, \$68; John P. Dutton, \$65; H. P. McTague, \$66.90; John McParland, \$63; John B. Foster, \$83.50; Peter Deehard, \$59.75; and Michael O'Rourke, \$72 per linear foot.

For a 15-foot main sewer on Forty-seventh Street from Mill Creek to Haverford Street, the bidders were: W. H. H. Achuff, \$30.75 per linear foot; James Deehan, \$42.85; J. P. Dutton, \$42; John Noondy, \$40.50; H. P. McTague, \$54.90; John McParland, \$47; J. B. Foster, \$53; P. Deehan, \$47.50; M. O'Rourke, \$49 per linear foot.

For a sewer on Herskell Street, north of Mill Street, in three sections of 9 feet, 8½ feet, and 4 feet in diameter, the bids were: W. H. H. Achuff, \$40, \$40, \$20; James Deehan, \$40, \$38, \$20; John P. Dutton, \$28, \$26, \$10; H. P. McTague, \$28.75, \$28.35, \$10; \$43.90, \$36.87, \$6; M. C. Hong, \$27.50, \$27.75, \$10.75; P. Deehan, \$31.80, \$27.80, \$7.90; M. O'Rourke, \$26, \$26, \$26, respectively.

For a 4x3 sewer on Eagle and Price Streets, the bids were: \$17.75, \$20, \$21.37 per linear foot.

For a 3½x2½-foot sewer in Wissahickon Valley the bids were \$9, \$11.85, \$9.74, \$14.37 and \$10 per linear foot.

For a continuation of the Manayunk intercepting sewer in three sections for the street of 9-inch brick 2½x3½ feet, the bids were: James Deehan, \$16.82; James Sullivan, \$15.85; Charles J. Kennedy, \$14.75 per foot.

For the second section of 13-inch brick 2½x3½ feet, the bids were \$17.85, \$17.85, \$25.50.

For the third section of cast-iron pipe of 2½x3½ feet, the bids were \$17.50, \$33, and \$25 per linear foot.

For a 7-foot sewer on Twenty-fourth Street, from York to Huntingdon, the bids were \$19.74, \$20, \$21, \$21.85, \$20.99, and \$23.70 per linear foot.

Bids were also received for a large number of branch sewers, small in length, the principal one being a 3x2 sewer on Brighthelm Street 2,175 feet long, the bidders being John McParland, \$3.90; Dietz & Murray, \$4.43; H. C. Eyre, \$4.73; David McMahon, \$4.80, and J. B. Foster, \$2.63 per linear foot.

The only bidder for grading on Fifth and Armstrong Streets was John B. Foster at twenty-two cents per cubic yard.

BOSTON.—Proposals for furnishing paving blocks were opened July 1 as follows: S. & R. J. Lombard, \$42 per 1,000 for the first 50,000, \$44 for the second 50,000, \$44.50 for 100,000; Rockport Granite Company bid \$53.50 for small and \$66.80 for large blocks; Pigeon Hill Granite Company bid \$58 for small and \$70 for large blocks; Cape Ann Granite Company bid \$46.44 for small and \$68.95 for large blocks; McDonnell & Sons bid \$43 for small blocks. No award was made.

NEW HAVEN, CONN.—Contracts on building the Almshouse were awarded July 7 by the Board of Selectmen as follows: Mason's contract, George M. Grant, \$105,540. The joiner-work, Larkins & Langley, \$57,144. Painters' work, E. R. Jeffcott, \$24,200. Plumbers' work, D. S. Kelly, \$5,600.

Steam-heating, New Haven Steam-Heating Company, \$14,980. All are new Haven parties.

MANISTEE, MICH.—The following bids for constructing brick sewers were received by Walter S. Denning, City Clerk, June 30:

Davies Bros., East Saginaw, Mich., \$32,998, complete; \$15,498 for two ends.

Frank P. Drew, Milwaukee, Wis., \$27,890, complete; \$11,720 for two ends.

Thomas Byrne, Chicago, Ill., \$28,913, complete; \$11,682 for two ends.

CINCINNATI, O.—Bids for paving Eastern Avenue with granite were opened June 29 by the Board of Public Affairs, as follows:

Materials.	Quantities.	Folz, Ashman & Co.	Thomas M. Steele.	F. Kirchner & Co.	M. J. Dady.
Curbs—	1500 lineal feet...	75	50	70	65
Grading—	4500 cubic yards...	30	30	30	30
Granite—	38,133 square yards...	30	30	30	30
Rolling—	9,500 square yards...	20	20	20	20
Gravel—	38,133 cubic yards...	20	20	20	20
Brick Masonry—	850 cubic yards...	40	40	40	40
Drain Pipe 24-inch—	400 lineal feet...	10	10	10	10
Drain Pipe 18-inch—	700 lineal feet...	10	10	10	10
Drain Pipe 12-inch—	300 lineal feet...	10	10	10	10
Drain Pipe 8-inch—	300 lineal feet...	10	10	10	10
One-third on 12-inch—	8 pieces...	10	10	10	10
One-third on 12-inch—	8 pieces...	10	10	10	10
One-third on 6-inch—	100 pieces...	10	10	10	10

Ashman & Co. filed New Hampshire granite; Steele filed Richmond granite; Kirchner & Co. filed Marlboro granite; Dady filed Richmond granite.

The bids were referred to the Engineer for computation and report.

GOVERNMENT WORK.

CHARLESTON, W. VA.—The following bids for iron work for lock gates and trestles for head bay of Lock No. 2, Great Kanawha River Improvement, were received at the U. S. Engineer Office and opened by Colonel William P. Craighead, July 1:

Builders' Iron Foundry, Providence, R. I., 43,000 pounds of wrought iron, 6½c. per pound; 22,500 pounds of cast iron, 6.5c. per pound; 2,200 pounds of steel, 15.5c. per pound; total, \$4,443.

Ainsler, Cochran & Co., Louisville, Ky., 6.5c., 5c., 2c.; total, \$4,184.

Queen City Bridge and Steam Forging Company, Cincinnati, O., 7.2c., 5.2c., 16c.; total, \$5,618.

SYNOPSIS of bids for columns, beams, girders, etc., for first, second and third floors of Court House, etc., at Rochester, N. Y., opened July 5 by the Supervising Architect of the Treasury Department: Phoenix Iron Co., Trenton, N. J., \$14,875; Dearborne Foundry Co., \$14,400; Thomas Marshall Foundry and Construction Co., \$14,947.81; J. B. & J. M. Cornell, New York City, \$14,712; Post & McCord, \$16,570.

SYNOPSIS of bids for approaches to the Post Office, etc., Quincy, Ill., opened by the Supervising Architect, of the Treasury Department, July 5: Larkworth & Menke, \$5,797.75.

SYNOPSIS of bids for dredging in the Virginia Channel of the Potomac River at Washington, D. C., opened June 30 by Colonel Peter C. Hains, U. S. Engineers: Morris & Co. Dredge Co., N. Y., 19c. per cubic yard; Ross & Sanford, Jersey City, 19c.; John H. McNee, Washington, D. C., 15c.

BROOKLYN.—Simpson & Co., of New York City, have received the contract for building the timber dry-dock at the Navy Yard.

ABSTRACT of bids for iron beacon for Milwaukee (North Point) Light Stat on Wisconsin, opened June 30 by Major S. M. Mansfield, U. S. Engineers: Russel Wheel and Foundry Co., Detroit, Mich., \$6,832; John Cooper, Mt. Vernon, O., \$9,865; West Point Foundry Association, Cold Spring, N. Y., \$7,800; J. G. Wagner, Milwaukee, Wis., \$14,800.

WASHINGTON, D. C.—Proposals for ten sets of steel forgings for 6-inch B. L. rifle guns were opened by the Secretary of the Navy July 6. But one bid was received, from the Midvale Steel Company, of Philadelphia, as follows:

For furnishing gun forgings, rough bored and turned, oil-treated and annealed.

Tubes and jackets for 6-inch B. L. R., 31.830 gross tons, \$885 per ton; total, \$28,169.55.

Hoops for 6-inch B. L. R., 26.480 gross tons, \$885 per ton; total, \$23,434.80.

Trunnion-bands for 6-inch B. L. R., 2.680 gross tons, \$1,344; total, \$3,601.92.

Plugs and mushrooms for 6-inch B. L. R., 1.040 gross tons, \$800 per ton; total, \$832.

Hoops for 10-inch B. L. R., 3.191 gross tons, \$1,232 per ton; total, \$3,931.

Grand total, \$59,969.58.

When the rough-boring and turning is done by the Department, 31.830 gross tons, \$716.80 per ton; total, \$22,815.74.

Hoops for 6-inch B. L. R., 26.480 gross tons, \$885 per ton; total, \$23,434.80.

Trunnion-bands for 6-inch B. L. R. (rough boring and turning to be done by the Department), 2.680 gross tons, \$885 per ton; total, \$2,371.80.

Plugs and mushrooms for 6-inch B. L. R., 1.040 gross tons, \$800 per ton; total, \$832.

Hoops for 10-inch B. L. R., 3.191 gross tons, \$1,232 per ton; total, \$3,931.31. Grand total, \$53,385.65.

This second bid is made with the understanding that if the rough-boring and turning of the tubes, jackets, and trunnion-bands are done by the Department, the Department will agree to rough-machine and de-

liver to the Midvale Steel Company on board cars Washington, D. C., each piece within twenty-one days after receipt of same in the rough, and all time in excess of twenty-one days on each piece required by the Department to make said delivery shall be allowed to the Midvale Steel Company in the contract-time of delivery of the set of which said piece forms a part.

PROPOSALS.

(Continued on page 148.)

COURT-HOUSE and office building at Lisbon, Dak. Until July 15. Address M. L. Engle, County Commissioner.

STEAM-HEATING of Ramsey County Court House, Minn. Until August 1. E. P. Bassford, 28 Gillilan Block, St. Paul, Architect. Address M. F. Kain, County Auditor, St. Paul, Minn.

SEWERS.—Proposals will be received until July 26 in the City Hall, Mankato, Minn., for the construction of the Front Street sewer and connections and appurtenances therefor. The work will comprise approximately as follows: 540 lineal feet 36x54 brick sewer, 4,100 lineal feet of pipe sewer from 9 to 18 inches in diameter, 18 manholes, 7 catch-basins, 4,000 lineal feet of house connections. William Davis, City Recorder.

IRON superstructure of bridge, also masonry, on Schier's Road, Symmes Township, O. Until July 30. Address Commissioners of Hamilton County, at the Auditor's Office in Cincinnati.

ERECTING Normal School at Moorehead, Minn. Until August 1. J. W. Stevens, St. Paul, architect. Address D. L. Kiehle, State Normal Board, St. Paul.

BOILERS.—Proposals will be received at the Toledo, O., Asylum for the Insane, until July 19, for the erection of a bath house; also for furnishing and putting in place two boilers. All to be in accordance with plans and specifications prepared by F. O. Fallis & Co., architects, and on file at the Toledo Asylum. Address the Trustees of the Toledo, O., Asylum for the Insane.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; h s dwell, brown-stone dwelling; apart house, apartment-house; ten, tenement; r, each s, owner; a, architect; b, builder; fr, frame.

AMONG THE ARCHITECTS.

We report the following from offices of New York architects:

Messrs. Cleverdon & Putzel have finished plans for a six-story brick storage warehouse to be erected at the corner of Chambers and William Streets, at a cost of \$40,000.

Herter Bros., architects, are making plans for nine flats, with stores, to be erected on One Hundred and Forty-fifth Street, between Eighth and Undercliff Avenues, for Mr. Francis J. Schnugg; cost, \$140,000.

Toledo, O.—Architect F. Charles Merry has made plans for a brick, stone, and terra cotta residence to be erected here for Noah H. Swaney at a cost of \$20,000.

Montreal, Can.—Architect Augustus Hatfield has made plans for a seven-story brick and stone fire-proof addition to the Richelieu Hotel. I. B. Durandier is the proprietor; cost, \$250,000.

NEW YORK CITY.

Bank st, s e cor West st, 5-story and cellar br factory cost, abt \$50,000; o, Enoch Morgan's Sons; a, John B. Snook & Sons; b not selected.

8-10 Birmingham st, 2 6-story br tailoring establishments; cost each, \$12,000; o, Lewis Krulwich; a, A. Munch.

258 East Broadway, 2 6-story br tens; cost, total, \$30,000; o, Julius Gross; a, Wm. Graul.

436-438 35th st, W, 2 5-story br and stone tens; cost each, \$19,000; o and b, E. D. Bertine; a, Ungrich & Houseman.

154 55th st, W, 3-story br and stone stable; cost, \$18,000; o, C. T. Barney; a, Bassett Jones.

Foot E 115th st, 2-story br generator house; cost, \$12,150; o, Standard Gas-Light Co, W C Andrews' President.

1724-1726-1728 Madison av, 3 5-story br tens; cost, each, \$16,000; o, W J Gessner; a, Schneider & Herter.

72d st, s s, 150 e 11th av, 4 4-story and basement br dwells; cost each, \$40,000; o, Michael Steinhart; a, G. B. Pelham.

105th st, n s, 106th st, s s, 175 w 9th av, and 106th st, n s, 100 w 9th av, 3 5-story br tens; cost each, \$20,000; o, A. M. Tompkins; a, A. Spence; b, day's work.

129th st, s s, 360 e 6th av, 3-story br and stone dwell; cost, \$10,000; o, Joseph Hewlett; a, A. B. Ogden & Son.

313-315 W 125th st, 5-story iron warehouse; cost, \$31,000; o, John Crawford, N. J.; a, J. F. Miller; b, E. Wilson.

Lincoln av, e s, bet 136th and 137th sts, 8 5-story br tens; cost total, \$100,000; o, J. T. Meagher; a, A. Spence; b, not selected.

E s 10th av, 99 s 35th st, br ten and store; cost, \$14,000; o, Jos Swartzler; a, Thom & Wilson.

109 Madison st, br flat and store; cost, \$19,000; o, Thos M Hugh; a, Alex J Finkle.

N w cor 10th av and 98th st, br flat and store; cost, \$20,000; o, Wm H Neebuh; a, F. T. Camp.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1880, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 7. } PUBLISHED EVERY SATURDAY.

NEW YORK, JULY 16, 1887.

LONDON, JULY 30, 1887.

SINGLE COPIES, TEN CENTS. }
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE. }
Subscription, 30s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

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92 & 94 FLEET ST., LONDON.

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THE AQUEDUCT BONDS OF THE CITY OF NEWARK.

A WARM controversy has arisen in Newark respecting the question of an overissue of bonds. The amount in debate is \$40,000, and from a careful reading of the statements made it does not seem that there is any evidence or intention of fraud. It is a question of the legality of the issue, this amount having been used as collateral, afterward marked canceled, and then four years afterward an equal amount regularly issued to complete the full amount of \$100,000 which had been authorized fifteen years before.

We mention the matter for the purpose of calling attention to the notoriously careless way in which such business is often transacted. It is to the interest of all that municipal business should be transacted in strict accordance with law, and with a careful observance of every safeguard indicated by experience.

Such bonds are sought for as investments of the funds of minors and others who can ill afford to suffer a loss; and anything which tends to lessen the confidence of the public in this class of securities is a general loss to the community.

STREET-LIGHTING IN LONDON.

THE last annual report of Mr. W. Hayward, Engineer to the Commissioners of Sewers of London, contains some facts of interest regarding the lighting of that city. The lighting hours of the public lamps are 4,300, and the thirty-six meters attached to lamps in various parts of the city show that the full contract quantity has been supplied. The price paid for gas is 2s. 6d. (60 cents) per 1,000 feet. Small lights, consuming five cubic feet per hour, cost \$17.36 for square lanterns, and \$18.39 for circular ones, which item includes lighting and repairing. Lights consuming ten feet per hour cost \$30.37 and \$31.40 each, according as the lantern is square or circular.

Mr. Hayward thinks that the Electric-Lighting Act of 1882 "has all but killed commercial enterprise on a large scale in electric-lighting." He says:

"During the year no part of the public ways nor any of the city bridges were lighted by electricity. The Edison and Swan United Electric-Light Company removed their wires and fittings from the Holborn Viaduct subways, and the lighting of private premises on the viaduct was discontinued in June. The proposal for lighting a large area of the city, made by the Brush Company, was under consideration, and a report upon it obtained from Mr. W. H. Preece, F. R. S., but up to the present time nothing definite has been settled."

THE NEW ORLEANS DRAINAGE CANALS.

THE importance of cleansing the drainage canals of New Orleans has again engaged the attention of the Auxiliary Sanitary Association of that city. Theoretically, these canals are to be kept flushed out by the contractors who operate the old-fashioned water-wheels which are relied on to secure a current in them. Practically, these ditches are receptacles for all sorts of rubbish, and through many of them water could hardly pass until they were cleared.

The president of the association, Mr. Fenner, has always been strongly in favor of the systematic and regular flushing of these canals and

opposed to attempts at improving drainage by raising of banquettes. It would seem, however, that any change in the present system of drainage must be an improvement.

HOSPITALS FOR CONTAGIOUS DISEASES.

WE have several times had occasion to call attention to the importance of providing special hospitals for the treatment of those forms of contagious disease in which isolation and disinfection are of special importance. The Municipal Council of Paris has been leisurely investigating this subject for the last three years through a committee, in behalf of which Dr. Chantemps has recently presented a report which is of interest in this connection.

It is certainly time that Paris should take some steps to diminish the proportion of contagious disease which seems of late years to have been increasing within her boundaries. The only special accommodation for such diseases which she now has consists of two barracks for small-pox, one connected with the hospital St. Antoine, and containing seventy-two beds, the other at the Hospital St. Louis containing sixty-four beds.

Nor can the methods actually in use in Paris for dealing with contagious disease be considered as at all satisfactory.

Theoretically, there is a very good set of rules and regulations for such cases, but practically they are not carried out. For example, the total amount expended during 1885 for the disinfection of infected localities was \$163. Disinfectants are stored at the police stations and in the municipal laboratory, but they are not used.

Dr. Chantemps proposes that two special small-pox hospitals shall be constructed, one for the northern and the other for the southern portions of the city, the two to contain 300 beds. It is also advised that two special wards for diphtheria cases be arranged in the two chief hospitals for children, at which also separate pavilions for scarlet fever and measles should be provided. Two stations for ambulances to convey contagious cases to hospital are to be provided, each to have six separate compartments, in each of which two ambulances are to be kept. The vehicles in each division are used for cases of one disease only, the diseases thus provided for being, small-pox, measles, scarlet fever, diphtheria, whooping-cough, and miscellaneous skin affections. There are also to be provided two disinfecting stations, with the usual apparatus for the use of superheated steam, etc. It will be seen that what is recommended is really needed for such a city as Paris, but it is doubtful whether anything will really be done until the stimulus of an epidemic compels attention to the matter.

While most of our large cities are better provided with means for circumscribing and destroying infection than Paris is, and make more use of them, it is, nevertheless, true that the majority of our cities of from ten to forty or fifty thousand inhabitants have no sufficient hospital accommodation, means of transportation, or disinfecting apparatus for dealing with contagious disease, and that until they are provided with these the efforts of health officials to control the spread of such disease must be of comparatively little use.

OUR BRITISH CORRESPONDENCE.

An Iron-Consuming Worm—Knighthood for Mr. Henry Doulton—New Coupling-Rod for Railway Wagons—Accepting a Pupil without Premium from the City and Guilds of London Institute—Lifting a Sunken Ship.

LONDON, June 29, 1887.

ACCORDING to the *Ironmonger*, there is a microbe which has been discovered in Germany, the existence of which is, if report be correct, a terror to engineers. The paper in question, however, doubts the existence of the pest. It is stated that owing to the corrosion of a rail, it was taken up and broken, and found to be hollowed out by a little gray worm of about two centimetres in length. This worm, to which was given the name "railoverous," is stated to carry on its head two small glands filled with a corrosive secretion, which is ejected every ten minutes into the iron, thus rendering it soft and spongy, in which state it is eaten by the intruder. The official report goes on to say that the worm had devoured 36 kilogrammes of rail in a fortnight. A worm, 2 centimetres in length and

Institute of Technical Education, on the recommendation of Professors Ayrton and Thompson. Mr. John Rance, Jr., is the first to receive the appointment.

An iron ship of some 1,293 tons, with a cargo of wheat of about 1,400 tons, which sank in February last in the Mersey directly over the new Mersey railway tunnel, and directly in the way of navigation, has just been lifted. The Mersey Dock Board does not show up well in the matter. They proposed to move the vessel by dynamite, but it was feared that if the explosive was used it would destroy the tunnel. Being apparently incapable of lifting the vessel, they advertised for tenders to raise it, and accepted that of a London syndicate composed of Messrs. Fletcher, Son & Fearnall, ship-builders and engineers; Bullivant & Co., wire-rope makers, and J. & G. Rennie. The tender for lifting and carrying the ship into shallow water was £15,000 (\$72,000), and the time given for the work was three months. It was actually carried out in five weeks. Four hulks, with an average lifting power of 500 tons each, were provided. Messrs. Bullivant supplied special wire ropes of 9 inches and 7 inches circumference.

surface at low water, the first lift was made and the wreck towed into shallow water, where the final lift was made. It is a matter of surprise that the Mersey Dock Board have not provision of pontoons and general plant and gear to effect such operations in such a highway as theirs, but they are, to all intents and purposes, incapacitated when such an accident as the present occurs. SAFETY-VALVE

OUR SPECIAL ILLUSTRATION.

Y. M. C. A. BUILDING AND TURNER BUILDING, NEWBURGH, N. Y.

OUR special illustration shows the Young Men's Christian Association Building (McKim, Mead & White, New York, architects) and the Turner Building (Messrs. Babb, Cook & Willard, of New York, architects) at Newburgh, N. Y. The larger building is that of the Association.

OUR VIGNETTE ILLUSTRATION.

RESIDENCE AT WASHINGTON, CONN.—R. H. ROBERTSON, ARCHITECT.

THE subject of our vignette illustration is the residence of Mr. E. H. Van Ingen, located at Washington, Conn.



RESIDENCE OF E. H. VAN INGEN, ESQ., AT WASHINGTON, CONN.—R. H. ROBERTSON, ARCHITECT.

described to be about the size of a prong of a silver fork in circumference, which will consume something like 75 pounds of iron in a fortnight, would probably be one of the wonders of the world.

Amongst the list of Jubilee honors, I see there is a knighthood for Mr. Henry Doulton, the chief of the well-known firm of Henry Doulton & Co., Lambeth.

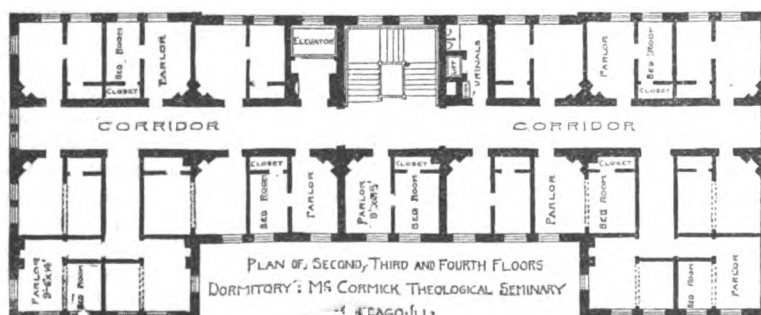
The question of couplings for railway wagons, and the consequent danger to human life under the old system, has long been a matter of discussion. A practical test, with the object of showing the working powers of a new coupling-rod, has just taken place on the Cheshire Railway at Walton. In the guards' test, twenty wagons were coupled and uncoupled with the rod in 1 minute and 37 seconds. By the shunters, the same work took 1 minute and 31 seconds. Against this, the old style of coupling and uncoupling by hand, to carry out which four picked men were appointed, took 2 minutes and 20 seconds.

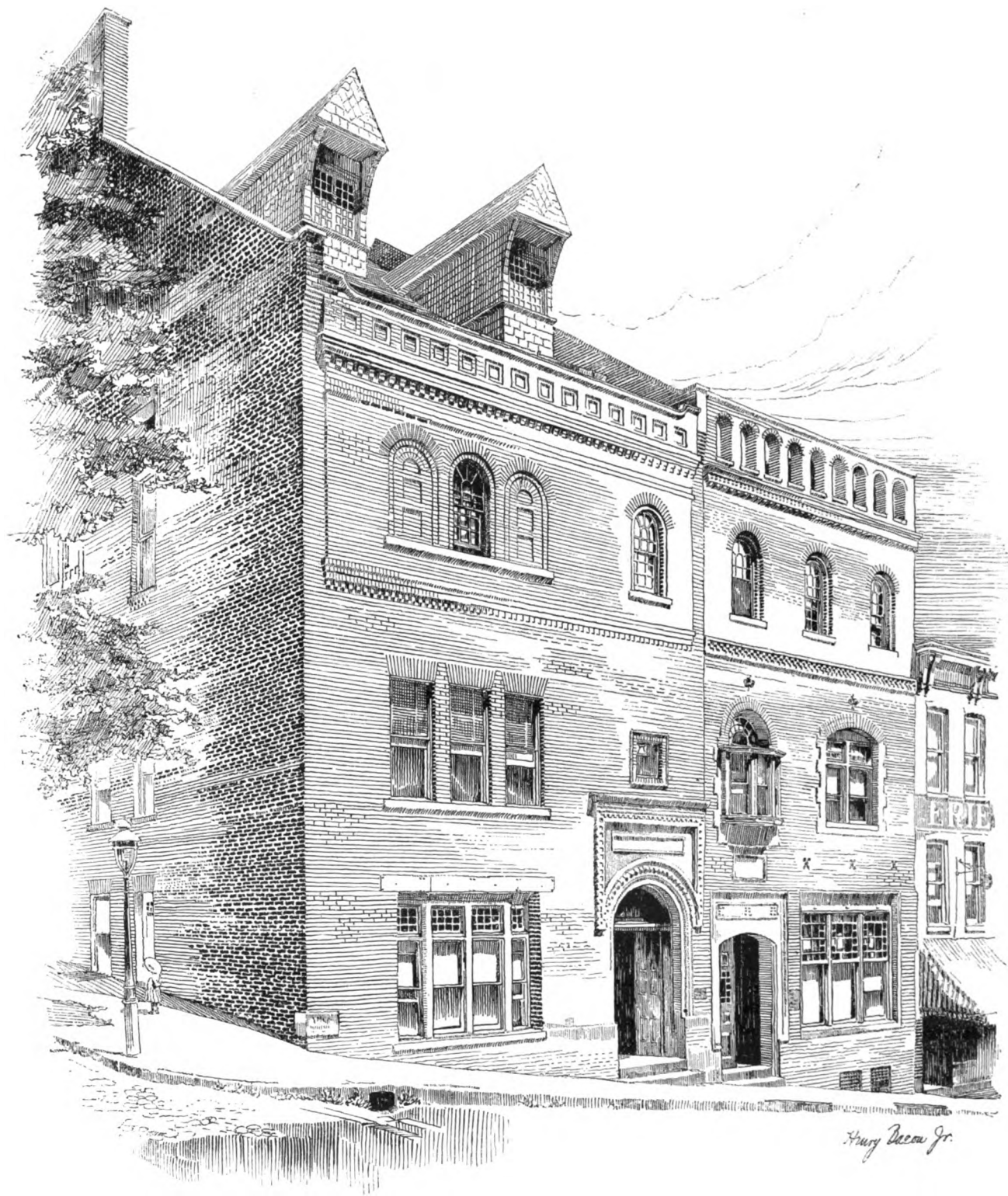
The Anglo-American Brush Electric Light Corporation has adopted a far-sighted policy in arranging to accept one pupil without premium from the City and Guilds of London

The 9-inch rope was constructed of 5 strands, each strand of 37 steel wires, the metal having a tensile strength of about 100 tons to the square inch, and a total breaking-strain of about 250 tons. Three double 7-inch strops and three of the 9-inch ropes were placed under the vessel, and attached to other ropes, thus forming slings, which were passed over the hulks and attached thereto by special clamps. These hulks had been strengthened by internal timbering, etc., to provide against nips. On the 14th inst., when the deck of the derelict was nine feet below the

The exterior is of local stone and frame and the inside finishings are of hard wood. R. H. Robertson of New York, is the architect.

THE accompanying illustration of floor plan of McCormick Theological Seminary, Chicago, A. Page Brown, of New York, architect, was inadvertently left out of our last week's issue.





THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

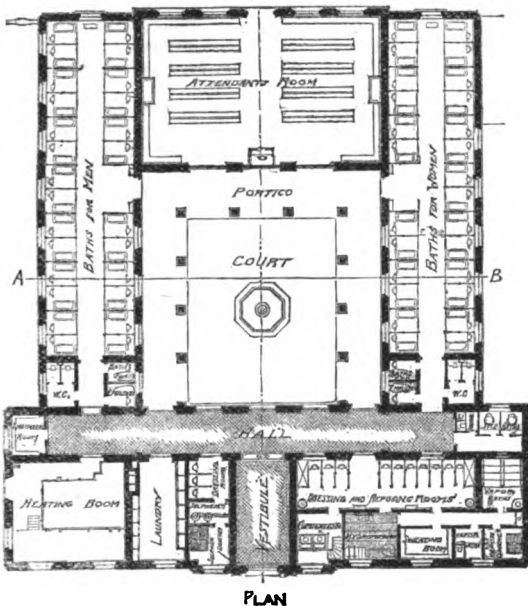
YOUNG MEN'S CHRISTIAN ASSOCIATION AND TURNER BUILDING, NEWBURG, N. Y.

McKIM, MEAD & WHITE—BABB, COOK & WILLARD, ARCHITECTS.



BATH-HOUSE OF THE HOSPITAL ST. ANTOINE, PARIS.*

THE hospital of St. Antoine, Paris, has accommodation, including the additions in progress or projected, for about eight hundred and seventy-five patients. The new bath-house, illustrated by the drawings reproduced herewith, was erected to meet the demand occasioned by the additions to the hospital. The baths are open for two sets of patrons—those who come from outside the hospital, and those who are regular patients, the afternoon being reserved entirely for the latter. The entrance for external patients is from the Rue de Citeaux at *d*, directly into the large waiting-room, which is provided with separate benches for men and women. The walls of this room are sheathed with pine about four feet high. Beyond the waiting-room is an open court surrounded on three sides by a covered passage, from which on either side open the large bathing-rooms for men and for women. These rooms are divided into sections enclosing the set tubs, by light sheathed partitions about six feet high, solid down to the floor, but closed only across the front by a curtain. Patients



are not allowed to touch either the wastes or supplies to the tubs, the attendants managing both. Two bath-rooms for the employees are at the extremity of each of the bathing-rooms. Opposite are two water-closets. All of these are separated from the bathing-room by a masonry wall.

The fourth side of the open court is occupied by rooms in connection with special baths, sitz-baths, showers, sulphur-baths, vapor-baths etc. In the axis of the building at *e*, opening from an interior avenue of the hospital grounds, is the entrance for regular patients. On the right are the robing and reposing rooms for the special baths. On the left are the linen-closets and the sulphur-bath and its robing-room. The robing-rooms are divided in sections by low sheathed partitions of same description as those in the bathing-rooms. At the extreme left is the boiler-room, with engine-room adjoining.

The cost of the entire bath-house was as follows:

Excavation and masonry	\$60,63
Carpenter-work	18 478
Roofing	5,068
Plumbing and general fixtures	19,654
Gas	608
Painting	1,696
Paving	674
Total	\$106,808

* Condensed from *Le Genie Civil*.

There are fifty-two bath-tubs for the use of the patients, besides the special baths and the baths for the employees. The architect was Mr. A. Grandjacquet.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
July 9.....	27.29	30.48	22.31	30.56	27.43	24.89	29.25

E. G. LOVE, Ph.D., Gas Examiner.

THE following figures concerning the illuminating gases of this city are abstracted for THE SANITARY ENGINEER AND CONSTRUCTION RECORD from the report of the Gas Examiner for the quarter ending June 30, 1887:

	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
Average Illuminating-power for the quarter.....	26.72	20.58	22.34	29.71	28.49	25.38	31.33
Sulphur, grs. in 100 cubic feet.....	3.37	11.85	29.46	4.77	4.48	2.74	5.69
Ammonia, grs. in 100 cubic feet.....	0.34	12.53	5.48	0.09	0.54	0.78	0.30
Specific gravity.....	.664	.462	.547	.748	.668	.637	.715

THE Bethlehem, Pa., Gas Company has reduced the price of gas, after July 1, ult., to \$2 per 1,000 feet, with a discount for prompt payment. The former price was \$2.50.

PERSONAL.

MR. GEORGE E. EVANS, who was City Engineer of Lowell, Mass., for about fifteen years, has accepted a position at Helena, Mont., in connection with the building of the water-works there.

NATHAN HILLES, at one time President of the Trustees of the Philadelphia Gas-Works, died in Frankfort, Pa., July 9, aged 72.

MAJOR JOHN S. BILLINGS, Surgeon, U. S. A.; Captain Washington Matthews, and Captain F. C. Ainsworth, Assistant Surgeon, U. S. A., have been appointed a Board of Medical Officers for the purpose of examining a candidate for admission to the medical corps of the army.

CAPTAIN RICHARD L. HOXIE, Corps of Engineers, U. S. A., now at Montgomery, Ala., has been ordered to temporary duty at Pensacola Harbor.

W. B. FULLER has been appointed City Engineer of Duluth, Minn.

JOHN W. MESUREAU, who died at Richmond, Staten Island, July 11, was many years ago a building contractor in New York City. At his death he was a director of the Staten Island Railroad.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

AN adjourned meeting of the Society (adjourned from the business meeting at the Convention) was held at the Society House on Wednesday, July 13, at 20:30 o'clock.

Ballots were canvassed, and the following were announced as elected for members of the Society:

John Ferris Alden, proprietor and engineer Rochester Bridge and Iron Works, Rochester, N. Y.; Frank Milligan Ashmead, resident engineer Allegheny Valley Railroad, Hulton, Pa.; William Henry Breithaupt (elected Junior June 4, 1884), chief assistant engineer on superstructure of Sibley, Fort Madison and other bridges of Chicago, Santa Fe and California Railroad, Kansas City, Mo.; Henry Thompson Douglas, chief engineer Baltimore and Ohio Railroad, Baltimore, Md.; Ulysses Stanislaus Lutz, principal assistant engineer in charge of Location and Construction Bloomsburg and Sullivan Railroad, Bloomsburg, Pa.; James Moore Shanly, resident engineer Massena Springs and Fort Covington Railroad, Montreal, Canada.

RECENT WATER-WORKS CONSTRUCTION.

No. XIII.*

WARE, MASS.

THIS small but enterprising town is located in Hampshire County on the Ware River and a branch of the Boston and Albany Railroad. It lies almost exactly midway between Springfield and Worcester and has about 6,000 inhabitants.

Cotton and woolen mills give employment to more than 2,000 operatives, and the river valley affords some opportunities for farming.

During the season of 1886 the town entered upon the construction of water-works with Frank L. Fuller, C. E., of Boston, as both consulting and constructing engineer.

The work was all under the direction of the three Water Commissioners, Messrs. C. C. Hitchcock, Edgar H. Guild, M. D., and Thomas C. Gleason. Rigid economy was practiced, but not to such an extent as to induce the Commissioners to endeavor to dispense with that important element of sound water-works construction—a distributing reservoir of ample capacity.

The temptation to excessive cheapness was not great in this direction, however, for the valley of the Ware River is enclosed at this point by hills rising 600 or 700 feet, and the reservoir is located on the slope within easy distance of the town, giving a head upon the distribution of from 75 to 225 feet—on Main Street about 192 feet.

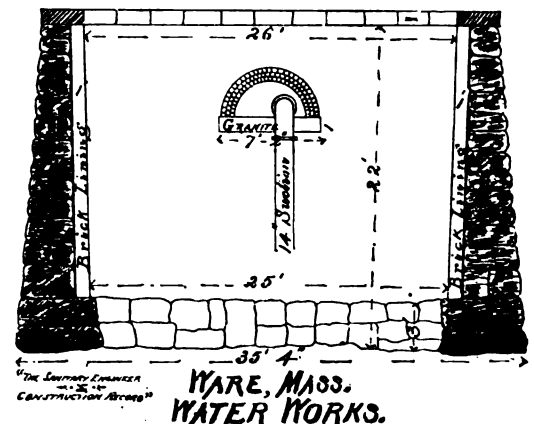
In the construction of the reservoir a saving of perhaps \$2,500 was effected by omitting the usual gate-house. The arrangement of screens about the inlet and outlet pipe is clearly shown in the illustration. The reservoir has a capacity at the high-water line of 1,557,600 gallons, and its construction involved:

8,433 cubic yards earth excavation.
881 " " rock excavation.
179 " " clay puddle.
638 " " concrete.
268 " " broken stone.
1,608 square yards stone paving.
355 " " sodding.

This work was done by F. A. Snow, of Providence, R. I., by contract, and cost about \$13,600.

A 12-inch gate in the main, outside the reservoir, permits the isolation of this portion of the system and gives

COLLECTING WELL.



an opportunity for direct pumping, should such an arrangement ever seem desirable.

Eleven test-wells were driven during the first two weeks in May, and the location of the collecting well was fixed upon the east side of Muddy Brook, a tributary of Ware River, at a point 300 feet from the brook and upon the site of an abandoned brickyard. After digging through 10 or 12 feet of clay, a porous gravel was reached, which has yielded, under continuous pumping by a Weber centrifugal pump, during the driest part of the season, from 600,000 to 700,000 gallons in 24 hours, by weir measurement.

The temperature of the water in Muddy Brook, April 19, 1886, was 57° Fah., and that of the water in a spring near the present well was 48°. On January 1, 1887, the brook-water was 34° Fah. and the well-water 49° Fah. It is said that a watering-trough formerly supplied with river-water froze over every winter, but that the same trough since it has been supplied with well-water has remained opened with the thermometer 14° below zero.

F. E. Shaw, of Providence, R. I., built the well in just three months' time. The water is forced by a compound,

*No. XII., the Water-Works of Charlottesville, Va., was published on page 657, issue of April 9.

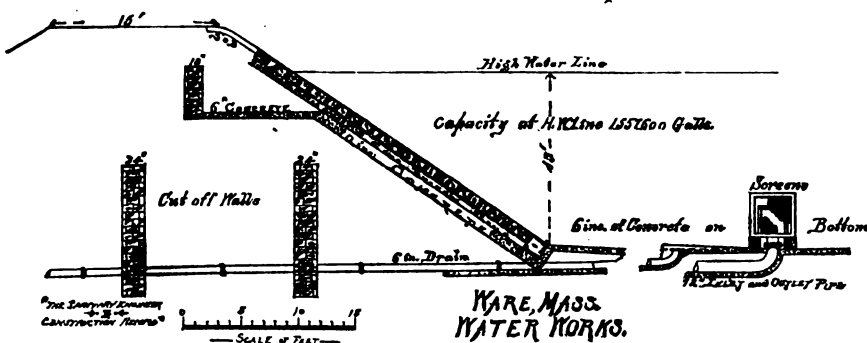
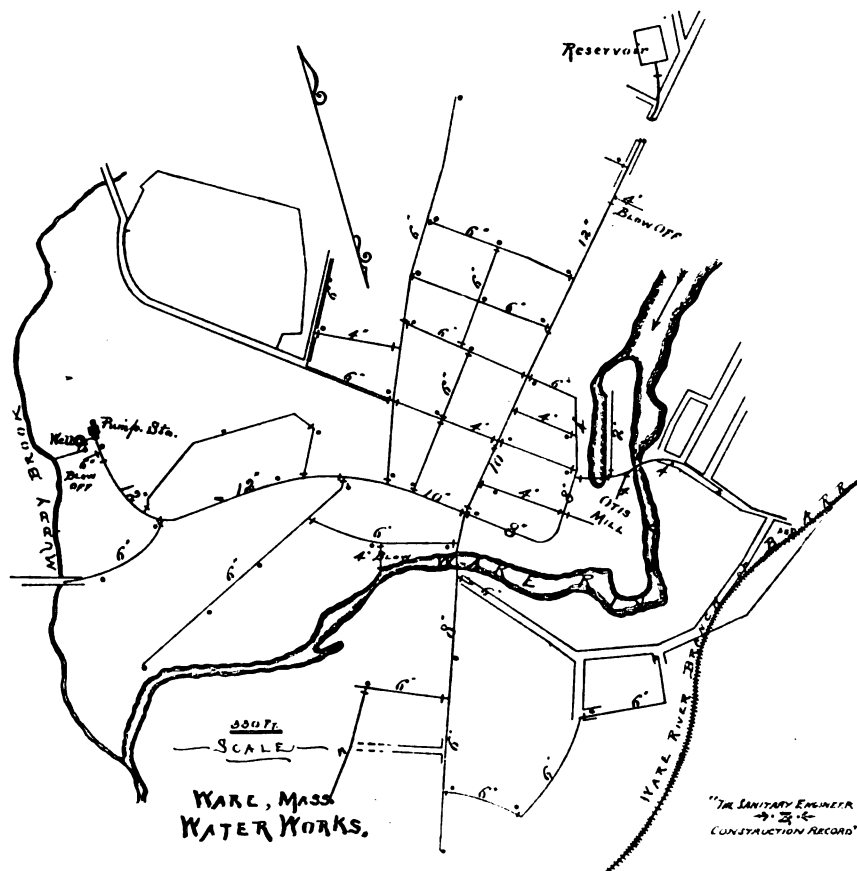
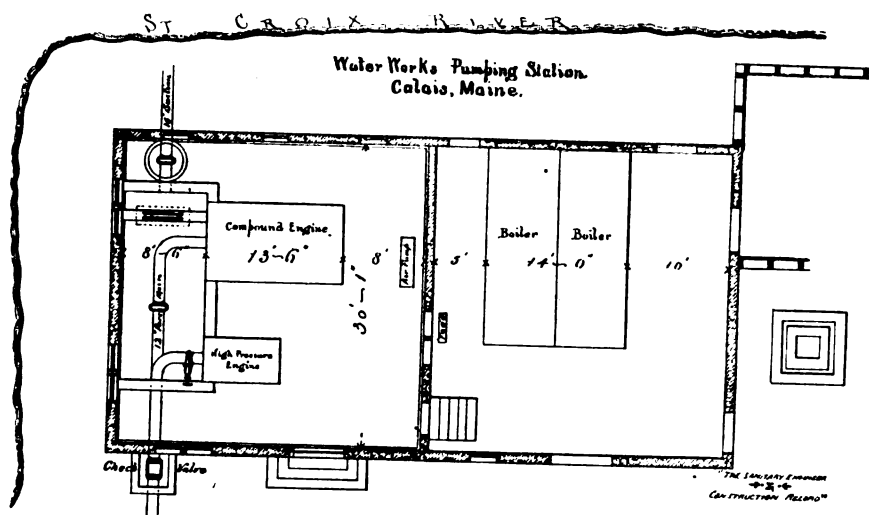
condensing, duplex pump, furnished by the Deane Steam-Pump Company, of Holyoke, Mass., through 7,700 feet of 12 and 10 inch pipe to the reservoir. The pump has a capacity of 1½ million gallons in 24 hours and has given a test duty of over 48 million foot-pounds with 100 pounds of coal.

Water for condensing is taken directly from the brook by a special connection rather than from the well.

December 15 Mr. Langford had laid 5.9 miles of pipe, with the usual gates and connections, at an average cost of about \$5,330 per mile.

The service pipes are of wrought iron lined with cement, having couplings and tees lined with composition.

The tasteful brick pump-house was built from designs of architect Ernest N. Boyden, of Boston. The total cost of the whole plant, not including land damages, may be set



The main distributing system is of cast iron, from the A. H. McNeal and Warren foundries, of sizes from 12 to 4 inches. A portion of the 4-inch pipe has been laid some years and has been used in connection with the pumps of the Otis Company's Mills as a means of fire protection. There are 48 hydrants and 57 gates, all from the Chapman Valve Manufacturing Company, of Indian Orchard, Mass. The pipe-laying was done by contract by John T. Langford, of Boston. Work was begun September 14, and by

down as \$72,500, and the fire district pays the town \$2.500 per annum.

CIVIL ENGINEERS' SOCIETY.

The civil engineers of Helena, Mont., are sending circulars over the Territory looking to the organization of a Territorial Society of Civil Engineers.

THE ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

(Continued from page 157.)

WEDNESDAY, JULY 6.

THE session to-day was opened at half-past 10 A. M.; and as the Chairman, Mr. T. C. Clarke, was absent, Mr. Robert McMath, of St. Louis, was appointed to fill his place.

The first paper was on "Disposal of Sewage in Massachusetts," by Frederic P. Stearns, and read by the author. The writer's treatment of the subject was local in character. He gives the population per square mile in 1880, which is for Rhode Island, 255; Massachusetts, 222; New Jersey, 152; Connecticut, 129; New York, 107; Pennsylvania, 95; Maryland, 95. Massachusetts is now more densely populated than France or Germany, and not far behind Italy, Great Britain, and Ireland.

A Massachusetts Drainage Commission was appointed in 1884 for the purpose of considering and reporting a general system of drainage for the relief of the valleys of the Mystic, Blackburn, and Charles Rivers, and for the protection of the public water-supplies of the cities and towns within the basin of said rivers.

Mr. E. C. Clarke was appointed Chief Engineer, who submitted his report to J. P. Davis and Rudolph Hering, as consulting engineers.

The present engineering staff consists of the writer as Chief Engineer and J. P. Davis as Consulting Engineer.

This State board is given advisory, and not mandatory, powers.

The next paper was a discussion of Mr. Stearns' paper by Charles Allen, and read by the Secretary.

The writer visited Europe in 1883, and examined various methods of sewage disposal in use there, the information so obtained to be used in suits against the city for polluting the Blackstone River, and also for determining the best methods of disposing of the sewage of the city.

The history of sewage in England dates back nearly half a century.

Early in the present century the rivers and streams became polluted in populated districts, and a large amount of capital invested in works for this purpose was nearly all lost. A few examples of early efforts are given:

"At Aldershot and Rugby the sewage was strained through planks perforated with holes three-quarters of an inch in diameter, but purifying effects were slight, for the amount of suspended matter was only reduced from 43.73 grains per gallon to 35.01 at Aldershot, with about the same result at Rugby, while the organic matter was 14.02 grains per gallon before and 8.77 grains per gallon after treatment."

"The more elaborate system of filtration, as practiced at Merthyr-Tydvil, when the sewage passed through a filter of coarse iron slag, about three feet thick, and then through another filter of coarse vegetable charcoal, the suspended matters were reduced from 169.81 grains to 32.31 grains per gallon, but soluble matters were not affected."

"Mr. Strong, of Glasgow, designed an apparatus with a filtering medium of coal ashes. The filtration was upward and solid matter retained in lower part of filter."

"At Birmingham sand filters were used with about the same success, while at Chelmsford and Belston clinkers and ashes were employed."

It was found that if filtering material was fine in texture it soon clogged, and if coarse it failed to remove a large amount of matter carried in suspension.

The result obtained in every instance of mechanical filtration tried was about the same.

"Birmingham originally tried subsiding tanks, which were about 90x50 feet; from thence it flowed over a weir guarded by floating boards into a tank of similar dimensions, and then over a weir into a third tank 30x150 feet, and then into a fourth about three times the capacity of the last, and carried from latter into a channel to the river Rea. A large portion of heavier matter was deposited in the tanks, for it took two hours for the sewage to pass through the series, but still the effluent water was very offensive. The combined system of sedimentation and filtration was scarcely less successful."

"The history of sewage treatment in England is full of failures; while some were nearly self-supporting, none of them paid."

"Their attention was given to irrigation and chemical precipitation which is practiced at the present time, and this system when the climatic conditions are favorable, a good effluent is obtained, but in no case, so far as able to learn, has any profit been made, for the sewage comes night and day, during rainy weather and dry, demanding constant attention. Most of the vegetable growth is very coarse and used principally for feeding cattle. Experience has shown it is necessary to provide one acre of land for each 100 inhabitants, that the land so used shall have a subsoil of gravel or sand, and properly underdrained if required, the drains being not less than five feet below the surface of the ground, and during heavy storms the sewage shall be filtered through beds especially prepared for the purpose or turned direct into streams."

Chemical precipitation was found expensive and failed to produce any profit. The failure to dispose of the sludge by this process was a great drawback to success.

"The best results were obtained by either one of the three following methods: 'The lime process' which is the most extensively used, the 'Coventry process,' and the 'A B C process.' The latter is very expensive and not in general use."

"The disposal of the sludge in some cases is a great drawback to the latter method. Still there is sufficient merit in the system to induce about fifty cities and towns in England to adopt it."

The sludge in all cases contains about ninety per cent. of water, and when spread upon land to dry sufficiently to handle it, in a short time becomes more or less offensive. But when a large percentage of the moisture is extracted by the sludge process, leaving the compressed cake in a condition to handle, the odor is removed.

"Dr. Frankland in 1870 suggested downward intermittent filtration as a means of purifying sewage, which was adopted by Mr. Bailey Denton in his practice."

It differs from broad irrigation in that instead of spreading sewage over a large surface of ground, having in view the raising of crops, a small area of porous land is selected and thoroughly underdrained, the tract being divided so that while the sewage is applied to one section, the other has a chance to rest and ground is thoroughly aerated.

Irrigation and chemical precipitation are the most extensively employed, downward intermittent filtration being principally used as an auxiliary to one of the methods.

The climatic conditions in Massachusetts are not as favorable to the proper treatment of sewage by irrigation or by filtration as in England and France, or even Germany.

"The Commission appointed by the State Board of Health in 1881, consisting of Charles F. Folsom, M. D., Joseph P. Davis, C. E., and Henry P. Walcott, M. D., reported as follows: Considering the extreme heat and cold of the climate, the heavy rainfall, and the dilution of the sewage, the difficulties in the way of a satisfactory disposal of the sewage of Worcester are far beyond those of any other town where the question has been met. So that any scheme that may be proposed may be said to be experimental to a certain extent."

The sewage farm at Pullman, Ill., was visited in January.

"This farm has an area of about 140 acres, nearly all of which is devoted to irrigation; there are ten acres, however, set apart for a filtration area, this being thoroughly underdrained, the drains being about twelve feet apart. On the day of our visit the thermometer was 40° Fah. The sewage was all being discharged upon the filtration area, the first section of which was covered with sludge to a depth of about one foot. The sewage running over this to the second section which was partially covered with ice, and then over the remaining area which was entirely covered with ice, and was finally discharged into the effluent trench without having been filtered in the least. I was told that not a particle of sewage has been applied to the farm proper during the winter, it all having been passed over the area already described.

"It takes careful management to prevent a sewage-farm from becoming offensive. The advantage to intermittent filtration over broad irrigation is that a much smaller area of land would be required, and the raising of crops would have to be made of secondary importance.

"To obtain good effluent, especially when the area of land is limited, some means of separating the sludge from the sewage is almost absolutely necessary, to prevent the ground from clogging. For the city of Worcester I have recommended chemical precipitation, with the possible addition of a filtration area, to be used in connection with the precipitation works during the summer months."

Oral discussion followed, Mr. E. C. Clarke, of Boston, being the first speaker, who gave a detailed account of the treatment of land with sewage at Medfield; one square acre of land having been devoted to this purpose. The surface was graded with highest point in centre of plot, having a slope from it in every direction of six inches per 100 feet. There were four equal divisions in the plot, and all sewage discharged at the centre; the flow continuing for two consecutive days only on a division, when it was turned on another; the discharge being at the centre, it could, therefore, be easily diverted. The interval between the intermittent flow would then be about one week.

The water-bearing soil extended to a depth of eight feet, which was gravelly in character, and surrounded by soil of a similar nature. The amount of sewage discharged was supposed to be about 36,000 gallons per day. Some trouble was experienced from the refuse of the dye-works, which was partially removed by placing slats on the outflow tank. This ground had never been underdrained. No trouble has ever been experienced in winter when the ground was frozen, even in the coldest weather. There was no odor to the soil treated.

At Pullman, near Chicago, where 140 acres are treated with sewage, there was perceptible odor; the sewage there being allowed to flow in one place for two months, and appeared to receive little attention. He did not think 100,000 gallons per acre per day too much for gravelly land. On clay-land and loam the purification is better than on light soils, but would require ten times the area of land to dispose of the same amount of sewage.

The fluid portion of sewage has been utilized for vegetation at Pullman, and found to greatly increase the crop. He thought that the temperature of the water-supply should be considered. If supply had always a very low temperature it would affect the success of the discharge of sewage.

Mr. Emil Kuichling, of Rochester, thought that sewage filtered through gravel was simply a mechanical operation. He stated that Professor Alexander Miller, of Berlin, who had charge of an experimental farm which is operated for profit, made a report to the Agricultural Society in 1885, in which he stated that the tendency was to reduce the quantity of sewage per acre per day, which in

Europe was from 30 to 50 gallons per head per day, and in the United States 50 to 160 gallons.

In England the amount of sewage was 1,100 gallons per acre per day. Sanitarians have demanded a reduction in the quantity to not more than 220 gallons, and in 1884 to 100 gallons, with a tendency to reduce it to 50 gallons if possible. He visited 30 or 40 sewage-farms in Europe, and on all the odor was a marked nuisance. Mr. Stearns stated that he had examined a similar number there and failed to discover any odor.

The odors in this case appear to be a changeable quantity. Mr. Kuichling referred to a report made by Dr. Tidy before the Society of Arts, England, giving rate of flow of sewage through settling tanks which are built in a series, about 6'x6', with sloping sides, and six feet deep. Time for first tank, two hours; second and third, four hours each; then discharged over a small weir; thence over a series of cascades, thickness of flow for latter being one-half inch.

Mr. Seth Green, of the New York State Fish Commission, stated to the speaker that a prevailing impression that trout would only live in pure water was erroneous. It was a question of temperature with them and not quality. They will live in water fit only for pigs to wallow in if cold enough. The surface of land irrigated with sewage has often been known to become clogged by a species of fungus, generally white in color, but sometimes red or orange. An engineer when making plans for sewage disposal by precipitation and irrigation should carefully consider what the sanitary effect would be in the future.

Mr. Robert McMath, of St. Louis, stated that the question to be decided at Chicago was how much more sewage can be carried off in the Illinois River without becoming a nuisance.

Mr. B. S. Church suggested that sewage be aerated by forcing compressed air through it, thereby removing the offensive odors. Data was now being collected in the Croton Valley for the purpose of deciding what disposal should be made of the sewage, but not far enough advanced to permit him to give any information.

Mr. E. Kuichling replied that an English chemist had made some experiments with aeration with unfavorable results, but were not carried to the extent proposed by Mr. Church. Chemical precipitation, which precedes irrigation, had met with much success in England.

A large portion of the details given in this oral discussion were brought out by questions from other members.

Mr. William H. Wiley extended an invitation to the members to visit the sewage-works now in process of construction at Orange, on Saturday afternoon, which was accepted. The discussion of sewage then closed.

Professor R. H. Thurston, of Cornell University, presented a statement of the land grants made by the Government for promoting technical education. He feared that some of the colleges and schools had lost sight of the object of this grant, and were devoting too large a portion to general education, which was not intended when the law was passed. He proposed that a committee be appointed to collect information by correspondence in the United States, and also in foreign countries, of the use similar funds were devoted, and act as an advisory committee only; to aid in creating a sentiment with those who may have charge of similar funds in this country favorable to the use these funds, acquired from the sale of public lands were intended to be applied. He feared that the main object of this fund had been lost sight of in many cases, through want of correct information on the subject, and thought that such a committee appointed by this society could do much to correct any irregularity in the use of these funds.

Mr. E. P. North thought that the Spanish language, which prevails in the Central and South American countries, where American engineers can look for employment in the future, should receive equal attention in colleges with French and German.

The morning session was then adjourned, to meet at 15 o'clock, or 3 P. M.

The afternoon session was opened at 15 o'clock, and the first paper presented was on Cable Railway Propulsion, by G. Leverich, of Brooklyn. The paper was mainly a detailed description of the appliances in use on the Brooklyn Bridge, of which an abstract cannot be intelligently presented without the drawings, which according to the regulations of the society cannot be used until after being issued by the society in its Transactions. There were twenty-seven drawings presented with this paper.

In reply to questions from members, he stated that the principal wear of the cable was due to the hard surface of the sheaves at the terminal stations, and that wherever the cable passed over soft material the wear was reduced. A grip having solid metallic jaws had been tried for one day, which caused a greater injury to the cable than months of constant wear of the grip now in general use on the bridge.

Large detailed plans were then exhibited of the mode of disposing of the sewage in Newark, N. J., a full illustrated description of which appeared in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, on page 600, volume 15, May 7, 1887.

Professor Thurston presented a large blue print copied from a drawing by a new mechanical process, which has also been described in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, and can be found on page 46, volume 16, June 11, 1887.

The Convention then adjourned to 20 o'clock, 8 P. M.

A business meeting was held at 20 o'clock, with the President, William E. Worthen, in the chair.

The first business transacted was the appointment of a Nominating Committee of five members not officers of the society. This committee will present to the Board of Direction, on or before the first day of November, the names of the persons selected by them as candidates for officers.

A distribution of members into districts collected from the society's list of membership, by Mr. J. P. Davis, was then presented by him.

Taking the resident members, there are 275; the rest of New York State, New England, and Canada, 207; New Jersey, Pennsylvania, Delaware, Ohio, Indiana, and Michigan, 156; Illinois, Missouri, Wisconsin, Minnesota, Dakota, Nebraska, Washington Territory, and Oregon, 150; all the rest of the States and Mexico, 144, which is about as well as the lines can be drawn.

Mr. Whittemore moved that the distribution of districts be adopted, which was carried. The districts will then be as follows:

No. 1.—Resident members, New York City, and fifty miles around it.

No. 2.—Rest of New York State, New England, and Canada.

No. 3.—Rest of New Jersey, Pennsylvania, Delaware, Ohio, Indiana, and Michigan.

No. 4.—Illinois, Missouri, Wisconsin, Minnesota, Dakota, Nebraska, Washington Territory, Oregon.

No. 5.—All the rest of the States and Mexico.

The following names were then presented as candidates by members from each district, and elected by vote of all members present at the meeting:

No. 1.—Colonel William H. Paine.

No. 2.—Clemens Hershall.

No. 3.—Frederick Graff.

No. 4.—R. E. McMath.

No. 5.—C. H. Latrobe.

A resolution was then presented by R. E. McMath for the purpose of taking the sense of the meeting:

"Resolved, That it is the sense of this meeting that it is expedient to create a grade of *students of the society*, said grade to consist of young men over eighteen and under twenty-five years of age, who are engaged in the study or practice of engineering. Connection with the society to cease as each individual student reaches the age of twenty-five, unless he shall be previously elected to a higher grade."

The privileges proposed to be granted by this grade are, attendance at meetings, and to receive the transactions of the society by the payment of a small fee.

After a long discussion the resolution was referred to a special committee, to be appointed by the President, which is all that could be done at this convention. To make any change in the constitution it will be necessary to submit a resolution at the annual meeting in January, and then, if passed, this resolution will be sent out for ballot to all the members of the society.

The President appointed on the Special Committee: Mr. Robert E. McMath, Colonel W. H. Paine, Professor R. H. Thurston, Mr. Robert Moore, Mr. Frederick Brooks.

Mr. E. P. North introduced the following resolution for the purpose of bringing the subject before the society, which was introduced by Professor Thurston at a previous meeting:

"Resolved, That the Board of Direction of the Society be requested to consider the advisability of appointing a committee on Technical Education and Professional Training, which shall annually report to the society the state and progress of such instruction in the United States and Europe as well, together with such data, statistics and suggestions relative to the subject as may seem to them proper. Said committee to co-operate with similar committees of other engineering societies, should such be advisable."

"Resolved, That such committees give especial attention to the matter of the formation and administration of those institutions known as the 'Land Grant Colleges,' established by the several States under the Morrill Bill of 1862, and report to what extent said colleges are carrying out the original leading objects prescribed by the funds donated under that law have been applied to such leading objects, and to what extent, if at all, diverted from their original purpose; and, further, to report what manner said funds may be in the future, in the opinion of the committee, rendered most useful in the promotion of the industrial arts and the education of the industrial classes."

Referred to the Board of Direction.

The business meeting then adjourned to Wednesday evening, July 13.

THURSDAY, JULY 7.

The convention was opened for discussion of papers about 10 A. M.

The Secretary read a letter from an officer of the Panama Canal Company, now in New York City, which traverses many of the statements made before the society recently by Mr. Bowlange, an engineer for several years in the employ of the company. The subject was discussed by Messrs. McAlpine, McMath, Cooper, Moore, and Bogart, from which the following information is given: The tide on the Atlantic side is about three feet, and six feet between maximum and minimum tide. On the Pacific side it is 24 feet, which will make tidal-locks necessary

at the entrance of the canal. The tidal flow in the canal would be from eight to ten miles per hour, but the tides are not simultaneous as to time of flow. The bed of the Chagres River is 45 feet above the bed of the canal, and surface flow of the river 45 feet higher at flood. The proposed dam is three-fourths of a mile in length at bottom and one mile long at top, and, as first proposed, 160 feet high. As there is no rock in the vicinity available for building purposes, the intention is to make an earth embankment. The rainfall on the Isthmus is from 194 to 200 inches per annum. To remove the large amount of water collected in the reservoir it is proposed to construct a canal similar in size to the present one, having a fall of from two to three feet per mile.

The next paper read was a discussion of Professor Robinson's paper on "Vibration of Bridges," by Thomas H. Johnson, of the Pittsburgh, Cincinnati, and St. Louis Railroad, Columbus, Ohio. Professor Robinson states clearly and correctly the manner in which trifling and inappreciable vibrations may have their amplitude enlarged to an indefinite extent by cumulative effects of continued repetition of the primary impulse at intervals "synchronous" with the time of vibration, and then proceeds to establish formula for determining by analogy from like formula of springs. Mr. Johnson states "that any analogy existing between a pin-connected iron-bridge truss and a tempered homogeneous steel spring lacks demonstration." Mr. Robinson next proceeds to find the conditions favorable to cumulative vibrations, in relations between the distance apart of the tracks under the cars, and the length of the panels in the bridge. But the Professor has previously shown that each bridge has a time of vibration peculiar to itself. This of necessity must remain constant for the bridge, whatever the amplitude of the vibration, or the intensity of the force producing it; just as a given pendulum will beat in equal time, however wide the arc through which it swings. The effect is, however, that the tracks under a freight train are very far from being uniformly spaced. They vary not only on any given road, but a still greater diversity would be found by comparison with cars used on other roads. The writer suggests that a possible cause might be found in the presence of "flat" wheels in the train—that is, wheels in which some part of the circumference has been worn flat by sliding on the rails.

A paper on "Stress of Bridges," by W. H. Booth, of Manchester, England, was next read. He states that the tendencies of the modern American and best English practice is towards a reduction in the amount of the factors of safety, but should be called the factors of uncertainty. It is clear that should a final determination of the full effect of any and every load upon a structure be accurately made, the factor of uncertainty would be at once replaced by a marginal factor which would serve to determine the true working strength of the structure under known load, and such working load would differ little from a loading that would cause final rupture. The old principle which allowed uniform stress upon every part of a bridge, whether references to its place in the structure have been discarded, the modern methods fully recognize that different details require different working stresses, the parts subject to suddenly applied loads are to be calculated as for static loads of much greater magnitude. The writer thinks that a rational method of procedure, to be followed in determining the total action of moving loads, ought to be expressed as equivalent static load when possible. He then proceeds to demonstrate his theory with formulas which would, to present an intelligent abstract, require more space than can be devoted to this interesting paper at present.

This and the preceding paper was discussed by Theodore Cooper, who stated that the vibration of the camber of a bridge will be less when a train passes over it at high rate of speed than it will when a train passes over it slowly.

The paper on "Compressive Strength of Steel and Iron," by Mr. Charles A. Marshall, had been prepared for presentation to the convention of 1886, but was withdrawn and rewritten for the convention of 1887. The experiments were undertaken to discover the relation which compressive strength of steel bears to tensile strength, and the inquiry was extended to include wrought iron. No attempt was made to test full-sized members of structures, nor any shapes but solid rolled bars as they came from the rolls, but the author believes that they indicate a general law, to which his attention had first been directed by Mr. James E. Howard, engineer of the testing-machine at the Watertown Arsenal—viz.: "That the elastic limit of the material is the chief factor in determining the ultimate resistance of struts of ordinary length made out of wrought iron or steel, excepting the very hardest kinds; and that the two quantities, elastic limit in compression and ultimate compressive strength, are identical within a considerable range of length ratio of columns." With reference to change of length under load, he concludes: "First—When a load equal to the elastic limit of any of these materials is imposed and allowed to remain for some time, it causes permanent change of length, amounting, it is believed, to much more than has been generally understood, and which is apparently a very definite quantity for each case. Second—This change of length having begun under a load equal to elastic limit, will continue under a less load. The plotted tests in tension were all so made as to develop the amount of this stretch; and it is demonstrated in the cases of the 100,000-pound steel, the 67,000-pound steel, and the hard iron made from scrap, that the total is obtained equally as well, though requiring greater length of time, with a load 1,000 or 500 pounds less than primitive elastic limit as with a load equal to that limit." The paper was accompanied by

many tables of compressive and tensile tests on steel bars of various diameters, also tests on wrought-iron bars.

In a paper by Mr. James G. Dagron, some experiments on the strength of Bessemer steel bridge compression members were described, which were made in connection with the construction of the Susquehanna River bridge on the Philadelphia branch of the Baltimore and Ohio Railroad. The steel was the manufacture of the Pittsburgh Bessemer Steel Company; the tests were made at the works of the Keystone Bridge Company, of Pittsburgh, contractors for the superstructure of the bridge. As a result of the tests, Mr. Dagron concludes that they show that "Rankine's formula cannot be used for steel columns in its present form by simply allowing an increase of load of 37½ per cent. for steel over iron compression members. If this formula is to apply, new numerical coefficients will have to be determined by a much greater range of experiments than those covered by the present paper, and it may then be found that in the law governing the flexure of steel columns of a given grade of material, increasing in length, the lateral stiffness of the material may become a factor of increasing importance in determining the stability of the column."

Mr. Mace Moulton, who was for a time in charge of the construction of the railroad bridge over the Ohio River, at Louisville, built by the Kentucky and Indiana Bridge Company, described the construction of this bridge. The original contracts were let in the fall of 1881, Mr. John MacLeod, of Louisville, being chief engineer, and Mr. C. Shaler Smith, of St. Louis, being consulting engineer. Complications arising with certain railroads, the work was for a time suspended and renewed under different contracts. The bridge was completed in the summer of 1885. The bridge is a system of cantilevers over the channel, with a total length between the centres of end piers of 2,453 feet. There is a continuous cantilever-system of 1,843 feet, "the largest yet constructed, so far as known to the writer." The difference between extreme high and extreme low water was 67 feet; and as the Act of Congress providing for the construction of bridges over the Ohio required that the lowest part of any structure spanning the channel of this river should be 40 feet above extreme high water, the bottom chord centre line had to be 107 feet above lowest low water. The specifications required the superstructure to be of oolitic limestone, with courses up to 18 feet above low water; 37 inches in thickness; stretchers not over 8 feet 6 inches long by 3 feet wide; and headers not less than 6 feet long by 3 feet wide. Above this the courses varied, with a minimum thickness of 2 feet 1 inch. The cantilever system was of steel in the trusses and iron in the floor; the remaining spans were entirely of iron. The estimated cost was a little more than \$1,000,000.

A discussion followed on a paper read before the Society by A. M. Wellington, on "American Line from Vera Cruz to the City of Mexico, via Jalapa, by O. L. Nichols, of the Suburban Rapid Transit Railroad, New York."

The writer states that it is not certain that the length of line and sharp curves will more than counterbalance the resistance due to a considerable increase of grade. It is absurd to attempt to lay down definite laws which shall be invariably followed in the location of all lines of railway. Each piece of topography is different from every other and requires special study and special treatment.

The paper under discussion leaves the impression that it was the custom to use continuous uncompensated grades of four (4) per cent. both on the English lines in Mexico and on the Peruvian railways. On two lines of Peruvian railways the minimum gradient is 1.06 per cent., and the maximum 3.94. The railway line in Peru begins at Callao and ascends to an elevation of 15,648 feet at Galena.

The next paper was a discussion of the same subject by A. Bryson, of the firm of Shunk & Bryson, of New York. The writer does not agree with Mr. Wellington, that a "switch-back," for surmounting high altitudes, when constructed as he proposes, that there is no loss of distance or time, but a gain.

Mr. Wellington stated that the "Abt System" is rather costly both for maintenance and renewal, and its range for profitable employment must be limited. The writer thinks that although portions of the system are rather costly, yet, when taken in connection with a certain saving in length of the line to construct, maintain and operate, with the strong probability—almost certainty—of finding easier ground, I think the first cost will be very much reduced, and show the system to be the most economical yet devised for mountain railways, both in first cost and in maintenance and operations.

Mr. W. W. Evans says in his paper on the Abt system (Trans. Am. Soc. C. E., March, 1886): "Any system which admits in expansion of limit of gradients will greatly reduce the cost of construction of new roads, but a system like that of Mr. Abt, which combines at once an extensive range of gradients with perfect safety and economy of operation will prove a perfect boon. All our construction expenses in excavation of earth and rock, in masonry per mile of road, will be similar, and the road itself will be materially shorter, and it will take much less time to build it and have it in operation. So great is the saving from all these sources that even including the extra expense for rock, rail, and engines, the cost per mile of the shorter Abt will never reach the cost per mile of the larger adhesion lines."

The cable system must be built at first for its maximum business, but not until that is reached will its operation become economical.

The switch-backs are limited in possible development, and when worked up to the full capacity of a single track,

with long sidings, present an element of danger. But each of these systems has its uses, and either may be at times advisable.

The meeting then adjourned to 15:30 o'clock.

The closing session of the convention was opened at 15:30 o'clock, and the only subject discussed was the maintenance and inspection of bridges. Mr. Wilson's paper was read at an earlier session, but placed with the last discussion for convenience.

Inspection and maintenance of railroad structures, by James M. Wilson, read by author: He stated that so many changes are being made from time to time, particularly in engines, that if a standard were adopted for the engine loads conforming to or covering a particular series of engines, it would not remain standard very long; it would, therefore, seem best if engines were considered separately to assume a typical engine, designed not only to some existing type, but to anticipate the outcomes of the future. So far as the framing of a law is concerned to govern this subject, railroads might be classified as first, second, and third class. The limit of live load should be made much higher than it generally is, and that recently authorized by the Pennsylvania Railroad met with his approval. Inside guard rails are apt to give trouble when obstructions fall on the track, and as outside guard rails are equally effective he preferred them. A tabulated list of all bridges on a road and complete detailed drawings with strain sheets calculated under certain assumed loads should be prepared. Each division of a railroad should have an assistant engineer competent to make examination of bridges, and under him should be a practical man, a superintendent of bridges, competent to make all needed repairs. They to be held responsible for the care of the bridges within the division. (If further expert examination is needed they ask for it.) Daily, weekly, or monthly examinations should be made, if necessary, which may be supplemented by daily inspection of the road foreman. Special inspection should be made once in two years by an expert. If these examinations are made by competent men, and advice carried out by the railroad company, there is no reason why the traveling public should not be efficiently protected.

Mr. G. H. Pegram states that bridge inspection should be made at long intervals of time by experts, rather than frequently by unskilled men. There seems to be no reason for specifying an engine wheel-base when better results can be obtained in much less time with a uniform load in combination with a single concentrated load. It does not seem expedient to adopt a standard bridge floor, because the proper floor to use will depend upon the construction of other parts of the bridge. Buckle-plates contain elements of danger on account of inaccessibility to inspection. He favors rails running to a point similar to the Latimer device, in addition to a guard-rail notched over the ties and having an angle-iron nosing throughout its length. Legislation on any points covered by the suggestion in the circular would seem inexpedient, because the selection of men with sufficient integrity and free from personal bias and political influence would be almost impossible.

A paper by Mr. J. A. L. Waddell, of Phoenix Company, was read by Robert Moore. The writer favored matured legislation to control bridge inspection that will require detailed plans and strain sheets, to be filed either at Washington or at capitals of States under which company was chartered, that have been made by a bridge expert. To prepare the laws relating to inspection and capacity of railway structure a committee might be appointed thus: The Government to choose a prominent member of the legal profession who has had experience in railroad matters, the President of the American Society of Civil Engineers to appoint two bridge experts, and then the three to choose another prominent member of the legal profession and a railway engineer of long experience. This committee should make a classification of roads according to character of their rolling stock and traffic, then prepare a general specification for bridges, designed so complete as to cover every detail—these specifications to be used for all new bridges, old bridges being allowed a percentage of deviation from these requirements. After the passage of these laws, let the Government give authority to the American Society of Civil Engineers to appoint a board of bridge experts to act as examiners of applicants for the position of "qualified bridge inspectors." No one who is not a full member of the American Society of Civil Engineers to have an examination, but the method of voting upon candidates in the society should be modified if this arrangement is adopted. A candidate should be required to have had ten years' practical experience (if a graduate of a technical school, six years), including three years devoted to bridge work. The committee to have power to annul an inspector's certificate for cause. The details of inspection should be: (1.) Measure systematically the dimensions of the structure and the sections of all the principal members, recording always in a uniform manner. (2.) The size of all parts in the neighborhood of each panel point, and each connection with main members, showing numbers, spacing, and diameter of rivets, including the distance of centre line of each piece from planes of symmetry, dimensions of eye-bar heads, thickness of bearings. (3.) All details of main members between panel points or connections, such as size of lacing-bars, stay-plates, stiffening angles, etc. (4.) Examine for any faults of manufacture or design, such as loose or unequally strained tension of members, bad packing, omission of fillers, bad riveting, twisted or otherwise distorted members, inefficient bracing, etc. Also the effect of wear, such as loose rivets, bent pins, rust, decayed timber, cracked castings and de-

fective masonry. (5.) Efficiency of floor system—viz., the ties, rails and guards, and means of protection from fire and vibrations, etc. (6.) Detailed description of substructure, with its relation to chasms or streams. (7.) Effect of rapidly-passing trains on the bridge. There should be several standards of rolling loads. A standard bridge-floor should be adopted, and would recommend that stringers be placed directly under the rails; that the ties be of 6x8 timber, laid flat and spaced twelve inches between centres, and every sixth or seventh tie to extend over the whole clear width of structure. Longitudinal 3x12 planks for a foot-walk, the remaining ties not exceeding 7 feet in length; that every tie to be bolted at each end to the stringers. Prefers inner guard rails of angle irons placed about 6 inches clear of the rails and bolted to alternate ties, these guard-rails extending to embankment, and drawn gradually together, terminated by an acute-angled frog. The limit of pre-connected spans should not be less than 100 feet, but lattice girders, as ordinarily built, are ruled out, and single intersection triangular riveted girders used instead. Recommends organizing an association of bridge designers and builders for the purpose of discussing bridge design in all its details, with the ultimate adopting of standard bridge specifications, so complete that upon looking over a design any competent engineer can determine without any doubt whether the proposed structure be fully up to the specification in the most minute particular.

The paper by Bouscaren was read by Mr. Whittemore. The writer does not think it practicable to establish a standard rolling load, nor a standard bridge floor, on account of variable weights of locomotives and trains on different roads. He prefers creosoted ties to buckle ties. Would not consider it expedient and desirable that a standard load, wheel-base floor and guard be fixed by legislation, but it is of the greatest importance that proper inspection be enforced by the State or general Government. The writer stated also that the great trouble with bridges is that a majority of them were first built to suit the manager, who considered the bridge from a financial and not from the engineer's standard.

A paper by G. Lindenthal, of Pittsburg, was read in abstract by Mr. McMath. "Proper inspection should include measurements of all dimensions, computations, and careful and minute examination of all parts of bridges, and complete working drawings, supervision of the piling, rolling and furnishing of the iron or steel, and testing the same, shop work and erection. Mandatory legislation on the inspection and maintenance of bridges is not advisable when such expert engineers are appointed by the Government to inspect and control the designs. The experience in Europe proves plainly that it does not work well. The Tay Bridge in Scotland, which fell down six years ago, was built under the immediate supervision of Inspecting Engineers of the English Board of Trade." The writer advocated inspection by experts. It is desirable to adopt a standard specified rolling-load much heavier than now used, but no specified wheel base.

The paper by J. S. Dagon was read by Robert Moore. The writer does not favor either national or State legislation in this connection, as there is a strong likelihood that appointments would be made more on account of their political influence than of their professional standing, but the remedy lies with the railway companies themselves. On roads where a permanent expert cannot be employed one should be called in once a year. It is questionable whether a standard rolling-load should be adopted. A standard bridge floor should be strong enough to carry a derailed engine. Space between ties should not exceed four inches. The ties to be notched one-half inch over the stringer, every third tie being fastened to the guard-rail and stringer by a $\frac{3}{4}$ -inch bolt, and intermediate ties fastened to the guard-rails by $\frac{3}{4}$ -inch bolts; ties not less than 8 inches deep, guard rails 6x6 inches, and notched one-half inch over ties. I would suggest the appointment of a committee, taken from the society, to thoroughly study the question and to report at the next annual meeting or next annual convention.

The convention then adjourned *sine die*.

FRIDAY, JULY 8.—"Home, Sweet Home."

At an early hour this morning Hotel Kaaterskill presented a lively scene, as the members and guests were preparing to leave the pleasant association they have enjoyed for the past week.

Mr. W. F. Page, manager of the hotel, tried to anticipate the wants of the members, and endeavored to do all in his power to make this convention one long to be remembered by its participants.

It has been noticeable that the best of feeling prevailed on all sides during the convention—not one single jar occurred to mar the harmony of the meetings.

At half past 8 A. M. the members bid adieu to the Hotel Kaaterskill, taking the stages provided, and were soon after proceeding at a rapid rate down the mountains, reaching Kingston about 11:30, where a portion of the party left the train for Binne Water to examine the cement works by invitation of F. O. Norton.

Mr. Norton sent a representative, Mr. C. M. Harris, to the hotel to meet the members.

Mr. Norton has introduced the latest improved machinery in the manufacture of cement, and also is using compressed air for power to work the drills, which has materially reduced the cost of quarrying rock.

The headings now extend under the mountain about 1,000 feet. A bountiful lunch was provided by Mr. Norton, which all present heartily enjoyed.

After the inspection of the cement works and lunch over, the party returned to Kingston and left by West Shore train for New York, where they arrived early in the evening.

The last good bye was said and the Nineteenth Annual Convention passed into history.

Members and guests at Convention:

New York—W. G. Hamilton, Stevenson Towle, Miss Alice Towle, Miss Jennie Towle, Miss Edith M. Spicer, Mr. and Mrs. John Bogart, Mr. and Mrs. William E. Worthen, Hon. William J. McAlpine, Miss Amita McAlpine, Gen. G. S. Greene, Mr. and Mrs. T. E. Brown, Jr., Mr. and Mrs. H. R. Bradbury, Mr. J. J. R. Croes and Miss Croes, G. S. Greene, Jr., Carlton Green, E. B. Gosling, J. N. Green, William J. Haskins, C. W. Hunt, Mr. and Mrs. E. P. North, Mrs. Henry C. Meyer, Mr. and Mrs. E. B. Noyes, Frederick S. Odell, G. H. Pegrar, E. F. Pierson, H. G. Prout, D. McN. Stauffer, R. J. Sloan, A. W. Trotter, Mrs. J. F. Trotter, C. Tompkins, Mr. and Mrs. W. H. Wiley, Mr. and Mrs. A. M. Wellington and daughter, Miss E. G. Crans, C. G. Curtis, Theodore Cooper, Mr. and Mrs. B. S. Curch, E. B. Dorsey, J. P. Davis, S. B. Downes, Mr. and Mrs. P. P. Dickinson, Mr. and Mrs. C. W. Durham, Mrs. G. H. Frost and son, G. A. Just, Mr. and Mrs. J. F. Flagg, Miss Flagg, Mr. and Mrs. William Kent, T. B. Lee, G. W. McNulty, C. Kirchoff, Jr., J. T. Nichols, E. L. Abbott, J. W. Russell, C. H. Haswell, Mr. and Mrs. Wardlaw, Mr. and Mrs. H. C. Clarke, Miss Clarke, Miss L. C. Clarke, H. C. Clarke, Jr., Mr. and Mrs. J. Thompson, Mr. and Mrs. J. T. Louis, G. H. Thompson, Mr. and Mrs. C. C. Schneider, Miss Schneider, F. A. Calkins, T. J. Holloway, A. Bryson, H. T. Swan.

Brooklyn—Mr. and Mrs. C. C. Martin, Miss C. A. Martin, J. W. Adams, W. A. Brackenridge, G. Leverich, Buffalo—Mr. and Mrs. T. C. Smith, Mr. and Mrs. E. B. Guthrie, Mr. and Mrs. C. W. Wagner, G. S. Field, E. Hayes.

Albany—J. McNaughton, H. Andrews, Mr. and Mrs. G. Devin, H. L. Van Zell.

Troy—P. C. Ricketts.

Hudson—J. Bartholomew.

Rochester—E. Kuichling.

Ithaca—C. L. Crandall, R. H. Thurston.

Oswego—C. D. Ward.

Poughkeepsie—W. T. Booth, C. E. Fogg.

Ramapo—E. F. Pierson.

New Rochelle—Mr. and Mrs. C. W. Hunt.

Boston, Mass.—C. H. Swan, Mr. and Mrs. G. A. Kimball, Mr. and Mrs. F. L. Fuller, E. C. Clarke, Mr. and Mrs. F. P. Stearns, F. W. Hodgedom, F. O. Whitney, C. P. Allen, F. Brooks, Mr. and Mrs. J. R. Richards.

West Newton—A. F. Noyes.

Cambridgeport—W. S. Barbour, Miss Julia H. Barbour.

Waltham—William Roberts.

Providence, R. I.—F. Filley, U. S. N., Mr. and Mrs. G. C. Tingley, Mr. and Mrs. S. M. Gray.

New Haven, Conn.—A. B. Hill.

Waterbury, Conn.—N. J. Welton.

Danbury, Conn.—Mr. and Mrs. J. W. Bacon, Mr. and Mrs. R. S. Read.

Middletown, Conn.—G. H. Bishop.

Bangor, Me.—Mr. and Mrs. T. W. Baldwin.

Augusta, Me.—Captain O. E. Michaelis, U. S. A.

Elizabeth, N. J.—Mr. and Mrs. F. Collingwood.

Jersey City, N. J.—Mr. and Mrs. J. Houston, Mr. and Mrs. J. G. Van Horne, Miss Van Horne, L. B. Ward.

Trenton, N. J.—C. Fisher.

East Orange, N. J.—F. C. Prindle, U. S. N.

Philadelphia, Pa.—Mr. and Mrs. H. W. Wilson, W. L. Ferguson, Mr. and Mrs. F. Graff, W. Jones, H. B. Seaman, J. S. Ringwalt, T. Roberts, Mr. and Mrs. S. L. Snedley, Mr. and Mrs. H. C. Felton, Mr. and Mrs. J. M. Wilson.

Phoenixville, Pa.—Mr. and Mrs. A. Bonzaro, Mr. and Mrs. A. Coffin, Mr. and Mrs. E. L. Griffin, W. H. Burr, G. S. Sniffin, S. T. Wagner, J. Sterling, Mr. and Mrs. P. F. Reeves, Miss Reeves.

Pittsburg, Pa.—W. W. Card.

Bethlehem, Pa.—H. S. Goodwin.

Chambersburg, Pa.—C. Ives.

Swarthmore, Pa.—A. Beardsley.

Scranton, Pa.—J. Archibald, Miss Archibald.

Bethlehem, Pa.—M. Merriman.

League Island, Pa.—T. C. McCollom, U. S. N.

Blairsville, Pa.—A. P. Kirtland.

Baltimore, Md.—Mr. and Mrs. M. Cohen.

Washington, D. C.—Robert Russell, M. S. Endicott, U. S. N.

Richmond, Va.—Mr. and Mrs. C. P. E. Burgwyn.

Youngstown, O.—Mr. and Mrs. H. G. Morse.

Zanesville, O.—Mr. and Mrs. F. G. Darlington, Mrs. E. A. Greene and Miss Greene, Mrs. Buckingham and Miss Buckingham.

Columbus, O.—C. N. Brown, W. H. Jennings.

Toledo, O.—B. Reece.

Akron, O.—W. D. Chapman.

Detroit, Mich.—Mr. and Mrs. F. B. Howard, Mr. and Mrs. J. D. Hawks, Miss J. P. Cooke.

Saginaw, Mich.—G. S. Burrows.

Milwaukee, Wis.—Don J. Whittemore, Miss F. M. and M. L. Whittemore, E. Whittemore, Miss L. Barnes.

Chicago, Ill.—R. A. Spailer.

Cedar Rapids, Iowa—W. W. Walker.

Ottumwa, Iowa—W. W. Hegeman.

St. Louis, Mo.—R. E. McMath, J. B. Johnson, E. D. Meier, J. A. Ackerson, F. C. McMath, Robert Moore.

Rolla, Mo.—G. D. Emerson.
Liberty, Mo.—W. C. Wetherhill.
Louisville, Ky.—J. MacLeod.
St. Paul, Minn.—S. Rockwell.
Minneapolis, Minn.—G. W. Sublito.
Greenville, Miss.—William Starling.
Socorro, New Mexico—C. F. Allen.
Paris, France—Henri Oesinger.
Ottawa, Canada—T. C. Keefer.

Regarding the inadequacy of the house now occupied by the society, the following circular will be issued to all members:

"At an informal meeting held at the Hotel Kaaterskill on July 4, 1887, at which a number of the members of the society were present, the President, Mr. William E. Worthen, stated that the society has grown to such extent that the present house had become inadequate, particularly for the meetings and for the convenient use of the library, and that it seemed of great importance to the welfare of the society that something should be done either towards building an addition to the present house, or, if it were practicable, the purchase of larger and more commodious quarters.

"The following resolutions were adopted:

"Whereas, the accommodation of the present society building is entirely inadequate for the purposes of the society, and it is deemed advisable without delay either to provide new quarters or an enlargement of the present building,

"Resolved, That the members and friends of the society are urged to contribute to the Building Fund as they may be able, in order that immediate measures may be taken by the board to accomplish this object.

"Resolved, That the board in its discretion may expend a reasonable sum in an addition to the present building.

"The sum of \$5,225 was directly subscribed by gentlemen present. [The list of subscriptions is given below.]

"The Board of Direction desires to take measures either towards the enlargement of the present house, or towards the purchase of other property. The determination as to which of these courses shall be taken must depend largely upon the amount of subscriptions to the Building Fund which shall be received within a short time. The subject therefore is presented to the members and friends of the Society. The Board of Direction feels that something must be done, and asks such response as may aid it in determining what is for the best interests of the society."

Subscriptions under resolutions adopted at a meeting of members held at Hotel Kaaterskill July 4, 1887:

W. G. Hamilton.....	\$1,000	F. G. Darlington.....	\$ 0
W. E. Worthen.....	500	E. B. Guthrie.....	20
P. P. Dickinson.....	100	J. M. Knapp.....	100
J. Bonzaro.....	200	William H. Wiley.....	100
D. J. Whittemore.....	500	H. E. Morse.....	50
Percival Roberts.....	200	S. B. Downes.....	50
William Roberts.....	100	John Thomson.....	55
John Bogart.....	100	W. W. Card.....	50
Mendes Cohen.....	100	Edwin Hayes.....	100
Joseph T. Davis.....	100	Washington Jones.....	100
Frederick Graff.....	100	S. B. Paine.....	50
Samuel Rea.....	50	D. McN. Stauffer.....	50
J. R. Richards.....	25	A. M. Wellington.....	50
F. Collingwood.....	100	G. H. Frost.....	50
James Archibald.....	100	Oberlin Smith.....	25
G. S. Greene, Jr.....	50	E. M. Eckert.....	100
J. G. Flagg.....	100	J. J. R. Croes.....	100
J. W. Adams.....	50	Stevenson Towle.....	100
T. Guilford Smith.....	100	Theodore Cooper.....	100
B. S. Church.....	50	A. Bryson.....	100
F. S. Odell.....	50	A. B. Hill.....	100
J. R. Wardlaw.....	50		

ANNUAL ADDRESS OF MR. WILLIAM E. WORTHEN, PRESIDENT OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

I WAS much gratified by my election as President of the American Society of Civil Engineers, a numerous body of men who fully represent the profession, and with whom I have been for a long time united. In assuming the office I undertook the duties of the position, which, however honorable, are not entirely without responsibility. I now proceed to fulfill one of the requirements by delivering an annual address, which is supposed to be a resume of what was done last year and the progress of the work of engineers, with some impressions of my own experience and my opinion with regard to the future.

I have collected sundry statistics from newspapers, magazines, etc., and although I have not credited them to the different parties, I yet follow the rule of the society in their publications, in not assuming the responsibility for the facts and opinions advanced, nor shall I back my opinions against facts if they are hereafter found in opposition thereto.

There is a little of the catastrophic in engineering science. It is essentially an evolved science; the works and facts from which it is evolved have been the accumulation of centuries; shrewd guesses or judgments worked out; a copying of examples; changing construction according to the teaching of experience, and application of varied material dependent upon location and requirements. Without going back into remote history, when the term engineer was not known, although there were wonderful examples of engineering construction, let us consider the growth of the science up to its present standpoint: Who built the first bridge? The change from wooden to iron structures is recent, yet how full is the record of steps? Who conceived the first railway? Its growth from the strap railway is wholly within our recollection. How many have contributed to make the turbine the wonderfully efficient and economic water-motor it now is? Who first thought of the application of steam to the purposes

of power? How many worked at the construction and improvement of boilers and steam-engines? We can pick out parts that were an essential improvement, and give the names of the men who first designed them, but the great body of the machine is made up of parts which have been constructed by mechanics without name, and not only the parts, but the machines to make the parts uniform and interchangeable.

Many an invention conceived before its time could be unearthed from patent records; either because it was not then needed, or the tools which made it economically and practicable were not to be had. How much development of industry has been given by the lathe, planer, and shaping machines? Seldom, if ever, in the lapse of a single year can we record any striking novelty which can be set down as a step in progress. It takes years to complete and practically test. Like the statue of "Liberty Enlightening the World," which is one of the accomplished facts of last year, it took many years to design, construct, and raise it. It is unfortunate, however, that in illuminating the world no provisions were made for illuminating the statue itself.

The name Engineer is of quite recent date, and is very mixed in its definition: the Architect preceded it. Architecture was always considered among the ancients as one of the liberal arts, but the name of architect was not given till a few centuries ago to artists charged with the construction of buildings. The man of the profession before the architect was the master of works, a practical builder; and work comprehended the entire building and its furniture. It is probable that the religious houses, which contained all that there were of men of letters, savants, and scholars on the Continent, furnished not only the men who designed and directed the monastic constructions, but also the civil ones, and perhaps military. The master of works became the head of a corps of workmen which made a part of these free corporations, which regulated wages and hours of labor, and defined rights and duties. Once outside of the cloister, work went on with great rapidity. The master workman was the acknowledged head; his name was connected with his work, and he was buried within the most prominent church he constructed. But the necessities of variation in designs and details soon brought in the artist and the architect, and something beside the construction of buildings was necessary.

In 1560-1641, Sully, Grand Master of Artillery and Superintendent of Finances of Henry the Fourth of France, was the first that appreciated the service that could be rendered by a body of geometicians and mathematicians, and he organized a *Corps de Genie*, which took the title of "*Ingenieurs Ordinaires du Roi*." This organization remained unchanged until the time of Colbert and Vauban, the latter the "*vrai pere de Genie Civil et Militaire*." L'Ecole Mezieres, established in 1748, was the first institution devoted to the development of the sciences. This was the period when the expression the "*Corps de Genie*" was introduced into the army. In England, the distinction between engineers became that of civil and military. It was evident in the discussion of the paper of Mr. Metcalf, on steel, before this society, that in the application of this material to the construction of guns and to civil purposes, no distinctions were drawn between the civil and the military, and the graduates from West Point are able civil engineers and fulfill that duty under the direction of the War Department. In general, the term engineer is supposed to come from engine, and the term engineer embraces not only the man who designs and constructs it, but the man who runs it. I suggest that there should be some distinction; that engineers should be such as are eligible to our society, and that the men who run and take charge of engines or machines should be called *engineers*. I want to reclaim, perhaps, a little more of "*le genie*" for the profession than for the mechanical artisan, for skill, experience, and industry may make a very good workman, but to this must be added more general and extended information in the application of materials to necessity, mathematics to calculate, and drawing to express, and, more than this, a sentiment of purpose, a feeling for the work. A true engineer is as much born as a poet. Could we divide the application of the term into engineer and engineers, it would be distinctive, and I would drop the term civil as embracing too large a profession, and adopt prefixes as military, hydraulic, railway, mechanical, steam, electric, and other divisions, when these are adopted as specialties. With regard to military engineering, I know of no particular progress of recent date. The War Department has undertaken to clear out Gedney's Channel, in New York Harbor, by pump dredging, and it is satisfactory to report that the work last year retained its depth without filling in, and a new contract has been entered into at about half the price of last year and is successfully progressing.

HYDRAULIC ENGINEERING.

Constructions for the use of water for power, city, and town supplies, hydraulic mining, and irrigation. In the census of 1880 will be found tabulated accounts of the water-power of the United States, developed and undeveloped. Attention is called to the low percentage of increase of water-power in comparison with that of steam:

In 1870, Water power, 1,130,431 H. P.	Steam, 1,315,711 H. P.
In 1880, " 1,225,379 "	" 2,185,418 "
Percentage of increase, 8.40	79.77

It will be seen that the percentage of increase of steam is very much in excess of that of water, but the latter still is not an inconsiderable amount, about 105,000 horse-power, equal to the power of the city of Lowell per year. A con-

venience of access to business and labor centres has tendered very largely to the increase of steam-power. And although there are immense water-powers yet undeveloped, and the cost of steam-power is largely in excess of that of water-power, yet position and its relations have decided in favor of steam. And where large manufactories have been commenced on water-power; and where the water-power has become exhausted, or very irregular, the business has been extended by the use of steam, rather than by a diversion of it to a new place for water. In 1844 I assisted Mr. U. A. Boyden in conducting his experiments on the first Fournayron turbines at the Appleton Mills, Lowell, Mass. This wheel gave 76 per cent. useful effect from the water, whilst some breast-wheels at Lowell, which Mr. Francis and myself tested some time before, gave from 60 to 66. Mr. Boyden afterward constructed many other turbines throughout the country, introducing many improvements in design and construction. One at Lawrence gave over 90 per cent. of effect. Boyden came of a very remarkable family, and had, above all men that I ever knew, that desirable genius, the genius of industry. He filled in all his time with scientific work and research. His relaxations consisted almost entirely of changes of subject. His improvements in water-wheels increased the water-power at Lowell about one-fourth over what was obtained by the former wheels, and gave him the means of pursuing other investigations of light, heat, sound, etc. His mode of experimenting was that now followed by Mr. Francis at Lowell and Mr. Mills at Lawrence. With the impulse given by Mr. Boyden, water-wheel shops were established in different parts of the country. The wheels were tested and improvements made, until now water-wheel construction has passed out of the hands of the engineers into those of manufacturers, who furnish wheels, ready made, simple efficient, and strong, guaranteed to give 80 per cent. effective power.

WATER-SUPPLY OF TOWNS.

There is a very large increase in the number of towns and cities supplied and addition to work already constructed. The great improvement in the matter of aqueducts has been in the application of wrought-iron for cast-iron mains, and also to take the place of masonry and tunneling. Large wrought-iron pipes for conducting water to turbines have been in use from the time of the introduction of the Boyden turbine wheel, but it has been left for California to largely extend its use for the conducting of water for hydraulic mining, irrigation and town supply with a boldness of design and execution which has astonished the engineer. The method of hydraulic mining was introduced or invented in California in 1852. The supply of water for these jets at first was conducted through hose made of heavy duck cotton cloth, which was strengthened by outer nettings of cordage when the pressure was large. In 1853, an ingenious miner laid in his mine a line of pipe consisting of ordinary stove-pipe, made of a very thin sheet-iron lightly fastened together with cold rivets, with the joints united stove fashion. This pipe was five or six inches in diameter. As hydraulic mining increased in magnitude the sizes of these supply-pipes also increased, the diameter for main lines for a large mine being from 22 to 30 inches. These pipes, as a rule, are made at the mine. The iron is from .055 to .134 inches (No. 16 to 10 Birm. gauge) in thickness, with a double row of cold rivets for the longitudinal seam when the pressure is to be large. As a protection against rust each joint is immersed for several minutes in a bath of boiling asphaltum and tar. They are now used for permanent conduits both for conducting water to mining districts across deep mountain gorges and also for the supply of cities. San Francisco, a place of some 300,000 inhabitants, receives its water through two lines of such pipes, and a third pipe, many miles in length and of large diameter, is now being laid for an additional supply. Within the last year one of the large shops in San Francisco has increased and improved its plant, so that they are now able to turn out weekly a mile of pipe 44 inches in diameter. Of the quantity of water necessary per inhabitant, there is considerable difference of opinion, but there is no doubt in the general opinion, that in the present use of water there is an extensive waste.

Of the quality of water for a town supply there is a great difference of opinion among chemists and scientists. M. Gerardin (*Rapport l'Alteration, la Corruption et l'Assainissement des Rivières*) says "the distinction between healthy waters and polluted ones cannot be detected by color, smell, taste, or chemical analysis. Water can be very much polluted without giving any smell. Such are the waters of paper-mills, starch and sugar works at the leaving of the works. Many natural waters which are prescribed in the case of sickness are very offensive in smell. Chemical analysis does not sufficiently explain the alteration of waters. If a perfectly healthy water be enclosed some time in a bottle, well-corked, its elementary analysis always manifests the same results, and, notwithstanding this, it has undergone radical change and has lost all its good qualities."

Chaptal says that those who make a chemical examination of waters only analyse its dead body. "Water is healthy when animals and vegetables of a superior organism can live in it; on the contrary, a water is affected when animals die, and it can only nourish infusoria. There is no better means of establishing the character of water than by determining if in this water fish and aquatic plants can live. If fish die there and plants perish there the character is certainly polluted, and the water should not be used for domestic purposes. On the contrary, if fish and aquatic plants can live in it the water can be considered good." There is an old French proverb, "*Il n'est pire eau que l'eau qui dort*," ("There is no worse

water than water which sleeps") which conveys the general impression with regard to the sources of supply. A running stream supplies the best water, and when reservoirs are necessary, the one from which the water is drawn directly should be as small as possible, and the water from superior reservoirs should flow down into it, so that the water may be well aerated in its course. Organisms are not dangerous because microscopic, and they are not, as a rule, dangerous. It is only, as an eminent scientist observed, when germs of disease are introduced from the outside, that the waters become dangerous, and organisms actually contribute largely to the purification of the water. If, by the doctrine that water once polluted is always polluted, it is to be understood that these pollutions are accumulations from century to century, then, for the preservation of our species, our own organisms must be changed to adapt us to the circumstances, and, in our new evolution, we should not be suited to the air and water of the garden of Eden and its suburbs. M. Gerardin, in the work above quoted, speaking of algæ, says they are endowed with a very active respiration. "The oxygen which they accumulate decomposes rapidly organic matter and they contribute largely to the purification of waters polluted by organic matters in decomposition. From the biological examination of the waters of various streams that are polluted by paper mills, and sugar, starch, and glue works, as it leaves the works and at different stages of the stream below, he finds that cryptogams and algæ first begin to appear, and thus up through the variety of forms to the higher and higher organisms, until fish appear in its waters and plants along its shore." Experiments in aquaria confirm this conclusion. I would refer to the report on pisciculture of James B. Ferguson, Commissioner of the United States at the Paris Universal Exposition of 1878, on the value of the algæ. He says: "Oxygen in its native state, resulting from the respiration of vegetable and especially from microscopic algæ, is very soluble in water. Atmospheric air introduced mechanically into water is not dissolved there, or if so in very small quantities." He quotes also from the Superintendent of the Aquarium his experiments on the aeration of waters supplied, as follows:

"The water of the Vanne, taken almost from its source, contains consequently little air and no organic germs; hence, although very useful for the cleansing and purification of the basins, it was not suitable to favor the rapid development of a cryptogamous vegetation upon the sides of the tanks. I substituted, therefore, the waters of the Seine, the color of which was, at that time, green on account of the abundance of microscopic germs, spores of algæ, conferva, and, in fact, all those vegetable aquatics—for the most part microscopic—the presence of which is requisite for the continuous oxygenation of water intended to receive fish. In truth, upon water as well as upon air, has been imposed that great law of nature which counterbalances and equalizes the animal and the vegetable kingdoms, making the one the indispensable auxiliary of the other.

"Fish, as well as animals on land, absorb oxygen by respiration, and give out carbonic acid, the quantity of which always increasing in the place which they inhabit, would not fail to produce asphyxia if the aquatic vegetable were not present to produce a chemically inverse effect. Under the influence of solar radiation the green immersed particles absorb carbonic acid, decompose it, assimilate the carbon, and exhale the oxygen, which appears upon their surface in innumerable small bubbles, supplying the fish with the respiratory element, renewed and endowed with a vital action so much the more efficacious because just brought to life, and possessing a solubility much greater than that of oxygen drawn from the atmosphere.

"Perhaps there is even a formation of bioxide of hydrogen, which would explain this coefficient of solubility as being so much greater than that admitted by chemists. However that may be, for me the fact is now incontestable that to establish in an aquarium a hygienic medium suitable for the life of aquatic animals, an abundant vegetation must there be developed, which should frequently undergo the action of solar radiation."

Most successful aquaria are constructed with what may be termed closed circuits, not drawing water from an exterior supply, except to make up waste. Water is used over again by aerating it in its circulation. C. B. Brush, a member of our society, has written a paper which will be read before the society, of experiments in forcing air into water by means of air-pump pressure at the Hackensack works, as he claims, with success.

Whether the cucumber taste of the Croton water be due to the *spongilla lacustrine* or to *nostoclonia*, it seems to me to be rather due to the want of circulation, and the decay and decay of some organism, by which the balance of aquarial life has not been properly kept up. The pabulum has failed, and perhaps it might be remedial to introduce a little sewage, as it has been shown by analysis that the sewage at Troy improves the water of the Hudson, and that the water-supply at Albany is better than that above. The algæ called frogs' spittle, *Batrachosperma moniliforme* (I might here remark, the smaller the organism the bigger the name), will always be found in the purest spring water. I am pleased to see them, and feel more sure of the purity of water by the presence of such common organisms than by their absence, understanding that within the microcosm there is a class of organism which depends on the usual food supplied by nature. Disturbance means disease, if not death. *Post hoc* is not always *propter hoc*; don't at once ascribe disease to the presence of an organism; and when you see crows or buzzards hovering around the carcass of a

horse, don't come to the conclusion that they have killed a valuable animal and shoot the crow or buzzard.

In the early times of gold-mining in California, hydraulic mining was the rule, but with the increase of value for agricultural purposes, the disturbance of rivers, and the covering of land with debris, this has been found very objectionable, and water has taken a value for irrigation, but with irrigation developments the necessity of defining water-rights has become indispensable, and a law was passed creating the office of State Engineer, and duties were assigned opening a large field of inquiry over an immense territory. The field of work is in the nature of a physical survey of the State combined with certain industrial, social, and other inquiries of a broad scope, and necessary to be prosecuted over a wide field.

The first part of the report has now come out, and it is for sale by the State of California. "It is introductory to the study of problems of irrigation, and is composed of a series of studies of irrigation development in the three countries of France, Italy, and Spain, from whose experience we propose to learn something for our own immediate purposes." We have referred to this report not only for its value in matters treated, but because like necessity exists in all our States to define the rights of water-users, whether for power or town supply, the drainage of land for agricultural purposes and sometimes irrigation, and in the discharge of polluted matter from streams. In whom does the title to water lie? Is it the first user? When the large city takes the entire flow of contiguous rivers and streams, whence is the fast increasing suburban population to be supplied, and once taken has any town or city the right to deprive others of this by waste? In 1883 an act was introduced into the New Jersey Legislature to provide for the appointment of commissioners to determine on plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply. With regard to this commissioners were appointed and a small amount of money was provided for expenses. The report was made, but no further action was taken. The commission is still in existence, but without power or money. In 1886 an act was passed by the Commonwealth of Massachusetts, requiring from the Board of Health a report on the condition and means for protecting inland waters. A report has been made under his act. This year a new bill was introduced to establish a Board of Water Commissioners, to provide for the establishment of water companies, and the general supervision of drainage connected with inland waters. Such boards are necessary in every State, not only to define the uses of water and the removal of waste within the limits of the State, but also there are interstate rights, and you can readily understand that the majority of such boards should be hydraulic engineers and with such powers as the State can delegate.

STEAM ENGINEERING.

In 1857, Mr. Charles W. Copeland and myself made the first experiments on pumping-engines at Belleville, N. J., and Hartford, Conn. (published in the *Brooklyn Water Works*, and issued by the City of Brooklyn). It may be remarked that the evaporation of the boilers from water at 100° will still be considered a very fair evaporation. But the duty per 100 pounds of coal was 55,000,000 to 62,000,000 on the Hartford engine and 68,000,000 to 73,000,000 on the Cornish engine at Belleville, now very much below the duty of first-class pumping engines. From the above experiments Mr. Kirkwood felt authorized to require by contract for the first Brooklyn engine a duty of 60,000,000 pounds per 100 pounds of coal. It is not now unusual to require 100,000,000 pounds or one-horse power for a little less than two pounds of coal per hour, and this taken on the water end of the machine. First-class pumping engines are now invariably compounded, and compounds have also been largely introduced in stationary engines and with largely economic results; of their exact comparative economy we need more tests.

When steam was first introduced for the heating of cotton mills, a boiler was placed at each end of the mill, with automatic water-feed by means of balance float. Later the boilers were concentrated within one house and the steam distributed through ranges of immense mills. The original steam-heating pipes were cast-iron, about three to four inches in diameter, and suspended from the ceiling; later, with the introduction of wrought-iron pipe, the pipe was carried around the walls of the mill, near the floor, but at present the wrought-iron steam-pipes are suspended from the ceiling. In mills where large quantities of steam are used for other purposes than power, it is common to pass the steam through a steam-engine for power, and then use the exhaust for drying, boiling, and heating. In 1866 I made a report to the Merrimack Manufacturing Company, of Lowell, on the economy of using steam first for power at the cotton mills and afterwards the exhaust at their print works for the purposes of heating, boiling, etc., and reported on the advisability of passing the steam through engines of 1,200 horse-power, and using the exhaust-steam afterwards in the print works, with a back-pressure of about six pounds, and that the amount of coal properly chargeable to power in this case would not exceed one pound of coal per horse-power per hour. It was a success, and of its present extent the superintendent of the works writes me as follows: "We have only one pair (34x72) condensing engine on our premises; all the others (something over 100 cylinders) exhaust into a system of mains, from which we draw all the heat we require. What we do not require for heat we take into the condensing cylinders, before mentioned, and reconvert into power." Some time since there was a boom in the

steam-heating of towns and cities from central stations, and many plants were constructed the most of which have gone out. There are still two in New York City, one of moderate size, comparing fairly well in extent with that of a large cotton mill plant; the other is very large and is still increasing its distribution. This result seems to argue the survival of the fittest.

RAILROADS.

There has been substantial progress in the extension of railroads, in the construction of new roads, and doubling and quadrupling the old ones. The estimation of construction for the year is 10,000 miles. The compound locomotive has been tested in Europe, but not sufficiently to afford a fair test of its practical value, and has not been put in operation here. The public has been greatly exercised by numerous accidents in the destruction of cars and passengers by fire, and our legislators have called for a safer means of heating and lighting than at present in use; in New York one year is given for the change. The two great questions of automatic freight-train brakes and automatic freight-car couplers have made great progress during the past year. The freight-brake tests which were made at Burlington, Iowa, in July of last year, have been supplemented by a second series this year; the two series together being by far the most complete tests of the kind which have ever been made. The results demonstrated that only air-brakes are adapted to the requirements. The prominent part of this year's tests was that taken by electricity as an actuating agent for applying the brakes, with results showing great benefit from its use, both in quickness of stop and in avoiding the dangerous shocks which result from quick stops with long trains. The electric application being absolutely simultaneous throughout the train, no shock whatever results. The occasional failures of the electric apparatus during the test indicated that further improvements are still needed, but as electricity simply supplements the air, which acts as usual in case of an electric failure, the probability seems strong that such electric application will be a feature of the train-brake of the future, while a percentage of efficiency was shown in this year's test, much greater than was ever shown before. As a safeguard for human life, rapid progress has been made toward the introduction of automatic freight-car couplers. The Burlington brake tests of this year and last show that it was on the whole decidedly beneficial to eliminate loose slack between trains which has tended to exclude couplings of the link and pin type, and the final step has now been taken by the formal adoption by the Master Car Builders' Association of the Janney hook coupler and others of the same type coupling with it as standards of the association, by a vote of 33 to 14.

STREET RAILWAYS.

The entire service of street railways was for many years by the means of horses, and we quote as to the cost of working the following returns taken from the sixteenth annual report of the Massachusetts Board of Railroad Commissioners: Highland, Lynn and Boston, Metropolitan, Middlesex, and South Boston; number of horses owned, 6,158; number of miles run, 11,287,196; number of passengers carried, 68,196,776; average number of passengers carried per round trip, 43.4.

From the above it appears that the stable average daily distance traveled by the above horses equals 10.04 miles.

The average number of passengers per round trip being 43.4, per single trip equals 21.7. Averaging them at 140 pounds, equals 3,038 pounds. Add weight of car, 4,800 pounds, equals 7,838 pounds.

With the great extension of street roads there have been found great inconveniences in this horse service, not only in the cost, but in the location of immense stables within populous neighborhoods. The usual traction force has been reckoned to be about $\frac{1}{10}$ per cent. in movement, and from 6 to 7 per cent. in starting on level grades. This will afford us a means of comparison between different forms of motors.

Although the cable road was used on the London and Blackwall Railroad for many years and for heavy trains, it was superseded by the locomotive, but it has of late years been revived in this country for the distribution of city travel and with great success.

Chicago has 20 $\frac{1}{4}$ miles of cable road in operation and 22 under construction; Cincinnati, 8 miles; Kansas City, 4 miles in operation and 30 under construction; New York City, 10 $\frac{1}{2}$ in operation; Philadelphia, 18 miles; St. Louis, 6 miles; San Francisco, 33 $\frac{1}{2}$ miles now in use; Melbourne, Victoria, has several miles; London, 3 miles, and four years ago a road was built in New Zealand. The first cable road in San Francisco was opened in 1873. This was the famous "Clay Street Hill Cable Road," where the grades were so steep that property was almost valueless. The cables had no trouble with the grades, 17 feet in 100, where horse power was useless and the road was an immediate success.

Mr. W. H. Paine, M. Am. Soc. C. E., has furnished me with the following facts in regard to the cable on the Brooklyn Bridge which he laid: "The practicability of applying cables to the hauling of large heavy passenger cars in trains at considerable speed with shorter headway, greater regularity and less danger from accident than any other method known is here demonstrated.

"The durability of the cable, and of the grips and dies has been here so great as to remove a most serious objection to cable traction.

Speed of cable, 10 miles per hour.

Length of cable, 11,000 feet.

Size of cable, 1 $\frac{1}{2}$ inches in diameter.

Weight, 3 $\frac{1}{2}$ pounds per lineal foot.

"The first cable was taken out last November, after having been in use three years and 41 days, having hauled 1,675,790 cars, 48,108,567 passengers, or 22,196,436 tons. The heaviest cars weigh 16 tons when empty, the heaviest load of passengers about 10 tons. The lightest cars weigh 11 tons when empty. Three cars are now hauled in one train. Shortest headway about 1 $\frac{1}{4}$ minutes. More than 100,000 passengers have been carried in one day. The grips will last for years with few repairs. The dies or lining of the grips last more than four months, sometimes exceeding five months. The speed of the cable, which is 10 miles per hour, could be increased, but without increasing the carrying capacity of the road."

ELECTRIC RAILWAYS

for street passenger traffic seem now to be a fixed fact. In Europe electric street railways are now carrying at the rate of 3,000,000 annually, and probably a little in excess of that number here, and they are extending. The first built was in Berlin, Germany, 1881, 1 $\frac{1}{2}$ miles in length. In this country they date from 1885. The following are the places in which they are established in this country. Baltimore, Md.; Los Angeles, Cal.; Port Huron, Mich.; Windsor, Canada; Detroit, Mich.; Appleton, Wis.; Scranton, Pa.; Denver, Col.; Montgomery, Ala. In all but one of these, the dynamo is driven by a steam-engine, but in Appleton, Wis., there is a road of $\frac{1}{4}$ miles, where water-power is used. You may recollect that an eminent divine once remarked as an evidence of design in the works of the Creator, that great rivers were placed near great cities. It were fortunate for the purpose of lighting and heating if great water-powers were placed in the vicinity of large populous districts. It has not yet been sufficiently decided how far power can be carried by means of electricity, nor the size of the conductor and the loss in conducting it. With the short roads now in operation it has been said that the percentage of effect on the car is 50 per cent. to 55 per cent. of that of the steam-engine providing the power. In this respect it is superior to the cable, which is fast superseding horses.

Few of the present engineers recollect the experiment of the old atmospheric railway of Samuda, which ran from Dublin to Kingston, about 1 $\frac{1}{2}$ miles, successfully for many years; and was later tried in a larger way from London to Croydon and from Paris to St. Germain. It failed and was superseded by the locomotive. It may be that for a moderate distance the atmospheric road may become practicable, but for the present our hopes of a successful motor, especially for city and town roads, are based on electricity. So much at least has been directed to this subject, not only with reference to power, but to light and heating, that a new branch of engineering has sprung up and has inaugurated itself into a society like our own as the American Institute of Electrical Engineers. From our knowledge of them and their claims I feel satisfied that they are to be a worthy branch of engineers. In our own country capitalization in electrical districts, telegraphic, telephonic, electric lighting, and electric power, amounts to a sum of at least \$350,000,000. There are in America about 700,000 miles of telegraphic wire; last year 32,000,000 conversations were held on the telephone; there are over 150,000 arc lamps, and incandescents verging on a million, and at least 15,000 electric motors for fans and sewing machines.

BRIDGES.

The first Howe truss was built across the Connecticut River at Springfield, Mass., in 1840. It was a wooden bridge with double intersections. Smaller bridges had been built in the same line of road, but this was a very important bridge at the time. Howe was a carpenter and the bridge was designed by average judgment, and the construction of one bridge made the precedent for another. Engineering science was not then applied to the calculating of stresses. Undue confidence in the form of truss, and the successful construction of many bridges in wood led to the Ashtabula accident. The strong desire for the construction of iron bridges at minimum cost, and the high price of iron, led to the construction of weak designs of this material, and postponed its adoption for many years. With the reduction of the price of iron, and a better understanding of the principles of construction, iron bridges have almost entirely superseded the wooden ones.

The forms have been calculated and tested by years of practical use, and they are furnished by engineering bridge companies in lengths to suit, and guaranteed to resist the stresses required. The finding of the jury in the Bussey Bridge disaster on the Boston & Providence Railroad is acknowledged to have been just, but this is not likely to occur with bridges as at present furnished, and subjected to careful inspection on the part of railroads. The limit of span has not yet been reached, nor perhaps the admissible height of skeleton piers, nor any form of truss or suspension established as the best. Cantilevers, from the ease of their erection without false works, are largely used, but esthetically in form they do not compare with the arch; yet extended use and knowledge of their "fitness for function" will soon reconcile one to the form.

GAS ENGINEERING.

Much has been done by improvements in mechanics and chemistry to increase the product of gas and reduce its cost. Water-gas is largely manufactured, and its uses extended in forging and welding. It is to be hoped that it may be distributed by mains throughout cities for the purposes of heating buildings and cooking. And although from experiment it has been demonstrated that water-gas has but 65 per cent. of the thermic value of the coal from

of power? How many worked at the construction and improvement of boilers and steam-engines? We can pick out parts that were an essential improvement, and give the names of the men who first designed them, but the great body of the machine is made up of parts which have been constructed by mechanics without name, and not only the parts, but the machines to make the parts uniform and interchangeable.

Many an invention conceived before its time could be unearthed from patent records; either because it was not then needed, or the tools which made it economically and practicable were not to be had. How much development of industry has been given by the lathe, planer, and shaping machines? Seldom, if ever, in the lapse of a single year can we record any striking novelty which can be set down as a step in progress. It takes years to complete and practically test. Like the statue of "Liberty Enlightening the World," which is one of the accomplished facts of last year, it took many years to design, construct, and raise it. It is unfortunate, however, that in illuminating the world no provisions were made for illuminating the statue itself.

The name Engineer is of quite recent date, and is very mixed in its definition: the Architect preceded it. Architecture was always considered among the ancients as one of the liberal arts, but the name of architect was not given till a few centuries ago to artists charged with the construction of buildings. The man of the profession before the architect was the master of works, a practical builder; and work comprehended the entire building and its furniture. It is probable that the religious houses, which contained all that there were of men of letters, savants, and scholars on the Continent, furnished not only the men who designed and directed the monastic constructions, but also the civil ones, and perhaps military. The master of works became the head of a corps of workmen which made a part of these free corporations, which regulated wages and hours of labor, and defined rights and duties. Once outside of the cloister, work went on with great rapidity. The master workman was the acknowledged head; his name was connected with his work, and he was buried within the most prominent church he constructed. But the necessities of variation in designs and details soon brought in the artist and the architect, and something beside the construction of buildings was necessary.

In 1560-1641, Sully, Grand Master of Artillery and Superintendent of Finances of Henry the Fourth of France, was the first that appreciated the service that could be rendered by a body of geometers and mathematicians, and he organized a *Corps de Genie*, which took the title of "*Ingenieurs Ordinaires du Roi*." This organization remained unchanged until the time of Colbert and Vauban, the latter the "*vrai pere de Genie Civil et Militaire*." L'Ecole Mezieres, established in 1748, was the first institution devoted to the development of the sciences. This was the period when the expression the "*Corps de Genie*" was introduced into the army. In England, the distinction between engineers became that of civil and military. It was evident in the discussion of the paper of Mr. Metcalf, on steel, before this society, that in the application of this material to the construction of guns and to civil purposes, no distinctions were drawn between the civil and the military, and the graduates from West Point are able civil engineers and fulfill that duty under the direction of the War Department. In general, the term engineer is supposed to come from engine, and the term engineer embraces not only the man who designs and constructs it, but the man who runs it. I suggest that there should be some distinction; that engineers should be such as are eligible to our society, and that the men who run and take charge of engines or machines should be called *engineers*. I want to reclaim, perhaps, a little more of "*le genie*" for the profession than for the mechanical artisan, for skill, experience, and industry may make a very good workman, but to this must be added more general and extended information in the application of materials to necessity, mathematics to calculate, and drawing to express, and, more than this, a sentiment of purpose, a feeling for the work. A true engineer is as much born as a poet. Could we divide the application of the term into engineer and engineers, it would be distinctive, and I would drop the term civil as embracing too large a profession, and adopt prefixes as military, hydraulic, railway, mechanical, steam, electric, and other divisions, when these are adopted as specialties. With regard to military engineering, I know of no particular progress of recent date. The War Department has undertaken to clear out Gedney's Channel, in New York Harbor, by pump dredging, and it is satisfactory to report that the work last year retained its depth without filling in, and a new contract has been entered into at about half the price of last year and is successfully progressing.

HYDRAULIC ENGINEERING.

Constructions for the use of water for power, city, and town supplies, hydraulic mining, and irrigation. In the census of 1880 will be found tabulated accounts of the water-power of the United States, developed and undeveloped. Attention is called to the low percentage of increase of water-power in comparison with that of steam:

In 1870, Water power,	1,130,431 H. P.	Steam,	1,315,711 H. P.
In 1880,	1,225,379 "	"	2,184,418 "
Percentage of increase,	8.40	"	79.77

It will be seen that the percentage of increase of steam is very much in excess of that of water, but the latter still is not an inconsiderable amount, about 105,000 horse-power, equal to the power of the city of Lowell per year. A con-

venience of access to business and labor centres has tended very largely to the increase of steam-power. And although there are immense water-powers yet undeveloped, and the cost of steam-power is largely in excess of that of water-power, yet position and its relations have decided in favor of steam. And where large manufactories have been commenced on water-power; and where the water-power has become exhausted, or very irregular, the business has been extended by the use of steam, rather than by a diversion of it to a new place for water. In 1844 I assisted Mr. U. A. Boyden in conducting his experiments on the first Fournayron turbines at the Appleton Mills, Lowell, Mass. This wheel gave 76 per cent. useful effect from the water, whilst some breast-wheels at Lowell, which Mr. Francis and myself tested some time before, gave from 60 to 66. Mr. Boyden afterward constructed many other turbines throughout the country, introducing many improvements in design and construction. One at Lawrence gave over 90 per cent. of effect. Boyden came of a very remarkable family, and had, above all men that I ever knew, that desirable genius, the genius of industry. He filled in all his time with scientific work and research. His relaxations consisted almost entirely of changes of subject. His improvements in water-wheels increased the water-power at Lowell about one-fourth over what was obtained by the former wheels, and gave him the means of pursuing other investigations of light, heat, sound, etc. His mode of experimenting was that now followed by Mr. Francis at Lowell and Mr. Mills at Lawrence. With the impulse given by Mr. Boyden, water-wheel shops were established in different parts of the country. The wheels were tested and improvements made, until now water-wheel construction has passed out of the hands of the engineers into those of manufacturers, who furnish wheels, ready made, simple efficient, and strong, guaranteed to give 80 per cent. effective power.

WATER-SUPPLY OF TOWNS.

There is a very large increase in the number of towns and cities supplied and addition to work already constructed. The great improvement in the matter of aqueducts has been in the application of wrought-iron for cast-iron mains, and also to take the place of masonry and tunneling. Large wrought-iron pipes for conducting water to turbines have been in use from the time of the introduction of the Boyden turbine wheel, but it has been left for California to largely extend its use for the conducting of water for hydraulic mining, irrigation and town supply with a boldness of design and execution which has astonished the engineer. The method of hydraulic mining was introduced or invented in California in 1852. The supply of water for these jets at first was conducted through hose made of heavy duck cotton cloth, which was strengthened by outer nettings of cordage when the pressure was large. In 1853, an ingenious miner laid in his mine a line of pipe consisting of ordinary stove-pipe, made of a very thin sheet-iron lightly fastened together with cold rivets, with the joints united stove fashion. This pipe was five or six inches in diameter. As hydraulic mining increased in magnitude the sizes of these supply-pipes also increased, the diameter for main lines for a large mine being from 22 to 30 inches. These pipes, as a rule, are made at the mine. The iron is from .055 to .134 inches (No. 16 to 10 Birm. gauge) in thickness, with a double row of cold rivets for the longitudinal seam when the pressure is to be large. As a protection against rust each joint is immersed for several minutes in a bath of boiling asphaltum and tar. They are now used for permanent conduits both for conducting water to mining districts across deep mountain gorges and also for the supply of cities. San Francisco, a place of some 300,000 inhabitants, receives its water through two lines of such pipes, and a third pipe, many miles in length and of large diameter, is now being laid for an additional supply. Within the last year one of the large shops in San Francisco has increased and improved its plant, so that they are now able to turn out weekly a mile of pipe 44 inches in diameter. Of the quantity of water necessary per inhabitant, there is considerable difference of opinion, but there is no doubt in the general opinion, that in the present use of water there is an extensive waste.

Of the quality of water for a town supply there is a great difference of opinion among chemists and scientists. M. Gerardin (*Rapport l'Alteration, la Corruption et l'Assainissement des Rivières*) says "the distinction between healthy waters and polluted ones cannot be detected by color, smell, taste, or chemical analysis. Water can be very much polluted without giving any smell. Such are the waters of paper-mills, starch and sugar works at the leaving of the works. Many natural waters which are prescribed in the case of sickness are very offensive in smell. Chemical analysis does not sufficiently explain the alteration of waters. If a perfectly healthy water be enclosed some time in a bottle, well-corked, its elementary analysis always manifests the same results, and, notwithstanding this, it has undergone radical change and has lost all its good qualities."

Chaptal says that those who make a chemical examination of waters only analyse its dead body. "Water is healthy when animals and vegetables of a superior organism can live in it; on the contrary, a water is affected when animals die, and it can only nourish infusoria. There is no better means of establishing the character of water than by determining if in this water fish and aquatic plants can live. If fish die there and plants perish there the character is certainly polluted, and the water should not be used for domestic purposes. On the contrary, if fish and aquatic plants can live in it the water can be considered good." There is an old French proverb, "*Il n'est pire eau que l'eau qui dort*," ("There is no worse

water than water which sleeps") which conveys the general impression with regard to the sources of supply. A running stream supplies the best water, and when reservoirs are necessary, the one from which the water is drawn directly should be as small as possible, and the water from superior reservoirs should flow down into it, so that the water may be well aerated in its course. Organisms are not dangerous because microscopic, and they are not, as a rule, dangerous. It is only, as an eminent scientist observed, when germs of disease are introduced from the outside, that the waters become dangerous, and organisms actually contribute largely to the purification of the water. If, by the doctrine that water once polluted is always polluted, it is to be understood that these pollutions are accumulations from century to century, then, for the preservation of our species, our own organisms must be changed to adapt us to the circumstances, and, in our new evolution, we should not be suited to the air and water of the garden of Eden and its suburbs. M. Gerardin, in the work above quoted, speaking of algæ, says they are endowed with a very active respiration. "The oxygen which they accumulate decomposes rapidly organic matter and they contribute largely to the purification of waters polluted by organic matters in decomposition. From the biological examination of the waters of various streams that are polluted by paper mills, and sugar, starch, and glue works, as it leaves the works and at different stages of the stream below, he finds that cryptogams and algæ first begin to appear, and thus up through the variety of forms to the higher and higher organisms, until fish appear in its waters and plants along its shore." Experiments in aquaria confirm this conclusion. I would refer to the report on pisciculture of James B. Ferguson, Commissioner of the United States at the Paris Universal Exposition of 1878, on the value of the algæ. He says: "Oxygen in its native state, resulting from the respiration of vegetable and especially from microscopic algæ, is very soluble in water. Atmospheric air introduced mechanically into water is not dissolved there, or if so in very small quantities." He quotes also from the Superintendent of the Aquarium his experiments on the aeration of waters supplied, as follows:

"The water of the Vanne, taken almost from its source, contains consequently little air and no organic germs; hence, although very useful for the cleansing and purification of the basins, it was not suitable to favor the rapid development of a cryptogamous vegetation upon the sides of the tanks. I substituted, therefore, the waters of the Seine, the color of which was, at that time, green on account of the abundance of microscopic germs, sporules of algæ, conferva, and, in fact, all those vegetable aquatics—for the most part microscopic—the presence of which is requisite for the continuous oxygenation of water intended to receive fish. In truth, upon water as well as upon air, has been imposed that great law of nature which counterbalances and equalizes the animal and the vegetable kingdoms, making the one the indispensable auxiliary of the other.

"Fish, as well as animals on land, absorb oxygen by respiration, and give out carbonic acid, the quantity of which always increasing in the place which they inhabit, would not fail to produce asphyxia if the aquatic vegetable were not present to produce a chemically inverse effect. Under the influence of solar radiation the green immersed particles absorb carbonic acid, decompose it, assimilate the carbon, and exhale the oxygen, which appears upon their surface in innumerable small bubbles, supplying the fish with the respiratory element, renewed and endowed with a vital action so much the more efficacious because just brought to life, and possessing a solubility much greater than that of oxygen drawn from the atmosphere.

"Perhaps there is even a formation of bioxide of hydrogen, which would explain this coefficient of solubility as being so much greater than that admitted by chemists. However that may be, for me the fact is now incontestable that to establish in an aquarium a hygienic medium suitable for the life of aquatic animals, an abundant vegetation must there be developed, which should frequently undergo the action of solar radiation."

Most successful aquaria are constructed with what may be termed closed circuits, not drawing water from an exterior supply, except to make up waste. Water is used over again by aerating it in its circulation. C. B. Brush, a member of our society, has written a paper which will be read before the society, of experiments in forcing air into water by means of air-pump pressure at the Hackensack works, as he claims, with success.

Whether the cucumber taste of the Croton water be due to the *spongilla lacustrine* or to *nostochonia*, it seems to me to be rather due to the want of circulation, and the decrease and decay of some organism, by which the balance of aquarial life has not been properly kept up. The pabulum has failed, and perhaps it might be remedial to introduce a little sewage, as it has been shown by analysis that the sewage at Troy improves the water of the Hudson, and that the water-supply at Albany is better than that above. The algæ called frogs' spittle, *Batrachosperma moniliforme* (I might here remark, the smaller the organism the bigger the name), will always be found in the purest spring water. I am pleased to see them, and feel more sure of the purity of water by the presence of such common organisms than by their absence, understanding that within the microcosm there is a class of organism which depends on the usual food supplied by nature. Disturbance means disease, if not death. *Post hoc* is not always *propter hoc*; don't at once ascribe disease to the presence of an organism; and when you see crows or buzzards hovering around the carcass of a

horse, don't come to the conclusion that they have killed a valuable animal and shoot the crow or buzzard.

In the early times of gold-mining in California, hydraulic mining was the rule, but with the increase of value for agricultural purposes, the disturbance of rivers, and the covering of land with *debris*, this has been found very objectionable, and water has taken a value for irrigation, but with irrigation developments the necessity of defining water-rights has become indispensable, and a law was passed creating the office of State Engineer, and duties were assigned opening a large field of inquiry over an immense territory. The field of work is in the nature of a physical survey of the State combined with certain industrial, social, and other inquiries of a broad scope, and necessary to be prosecuted over a wide field.

The first part of the report has now come out, and it is for sale by the State of California. "It is introductory to the study of problems of irrigation, and is composed of a series of studies of irrigation development in the three countries of France, Italy, and Spain, from whose experience we propose to learn something for our own immediate purposes." We have referred to this report not only for its value in matters treated, but because like necessity exists in all our States to define the rights of water-users, whether for power or town supply, the drainage of land for agricultural purposes and sometimes irrigation, and in the discharge of polluted matter from streams. In whom does the title to water lie? Is it the first user? When the large city takes the entire flow of contiguous rivers and streams, whence is the fast increasing suburban population to be supplied, and once taken has any town or city the right to deprive others of this by waste? In 1883 an act was introduced into the New Jersey Legislature to provide for the appointment of commissioners to determine on plans for the storage of any of the waters of this State for the purpose of furnishing to cities and towns a joint water-supply. With regard to this commissioners were appointed and a small amount of money was provided for expenses. The report was made, but no further action was taken. The commission is still in existence, but without power or money. In 1886 an act was passed by the Commonwealth of Massachusetts, requiring from the Board of Health a report on the condition and means for protecting inland waters. A report has been made under his act. This year a new bill was introduced to establish a Board of Water Commissioners, to provide for the establishment of water companies, and the general supervision of drainage connected with inland waters. Such boards are necessary in every State, not only to define the uses of water and the removal of waste within the limits of the State, but also there are interstate rights, and you can readily understand that the majority of such boards should be hydraulic engineers and with such powers as the State can delegate.

STEAM ENGINEERING.

In 1857, Mr. Charles W. Copeland and myself made the first experiments on pumping-engines at Belleville, N. J., and Hartford, Conn. (published in the *Brooklyn Water Works*, and issued by the City of Brooklyn). It may be remarked that the evaporation of the boilers from water at 100° will still be considered a very fair evaporation. But the duty per 100 pounds of coal was 55,000,000 to 62,000,000 on the Hartford engine and 68,000,000 to 73,000,000 on the Cornish engine at Belleville, now very much below the duty of first-class pumping engines. From the above experiments Mr. Kirkwood felt authorized to require by contract for the first Brooklyn engine a duty of 60,000,000 pounds per 100 pounds of coal. It is not now unusual to require 100,000,000 pounds or one-horse power for a little less than two pounds of coal per hour, and this taken on the water end of the machine. First-class pumping engines are now invariably compounded, and compounds have also been largely introduced in stationary engines and with largely economic results; of their exact comparative economy we need more tests.

When steam was first introduced for the heating of cotton mills, a boiler was placed at each end of the mill, with automatic water-feed by means of balance float. Later the boilers were concentrated within one house and the steam distributed through ranges of immense mills. The original steam-heating pipes were cast-iron, about three to four inches in diameter, and suspended from the ceiling; later, with the introduction of wrought-iron pipe, the pipe was carried around the walls of the mill, near the floor, but at present the wrought-iron steam-pipes are suspended from the ceiling. In mills where large quantities of steam are used for other purposes than power, it is common to pass the steam through a steam-engine for power, and then use the exhaust for drying, boiling, and heating. In 1866 I made a report to the Merrimack Manufacturing Company, of Lowell, on the economy of using steam first for power at the cotton mills and afterwards the exhaust at their print works for the purposes of heating, boiling, etc., and reported on the advisability of passing the steam through engines of 1,200 horse-power, and using the exhaust-steam afterwards in the print works, with a back-pressure of about six pounds, and that the amount of coal properly chargeable to power in this case would not exceed one pound of coal per horse-power per hour. It was a success, and of its present extent the superintendent of the works writes me as follows: "We have only one pair (34x72) condensing engine on our premises; all the others (something over 100 cylinders) exhaust into a system of mains, from which we draw all the heat we require. What we do not require for heat we take into the condensing cylinders, before mentioned, and reconvert into power." Some time since there was a boom in the

steam-heating of towns and cities from central stations, and many plants were constructed the most of which have gone out. There are still two in New York City, one of moderate size, comparing fairly well in extent with that of a large cotton mill plant; the other is very large and is still increasing its distribution. This result seems to argue the survival of the fittest.

RAILROADS.

There has been substantial progress in the extension of railroads, in the construction of new roads, and doubling and quadrupling the old ones. The estimation of construction for the year is 10,000 miles. The compound locomotive has been tested in Europe, but not sufficiently to afford a fair test of its practical value, and has not been put in operation here. The public has been greatly exercised by numerous accidents in the destruction of cars and passengers by fire, and our legislators have called for a safer means of heating and lighting than at present in use; in New York one year is given for the change. The two great questions of automatic freight-train brakes and automatic freight-car couplers have made great progress during the past year. The freight-brake tests which were made at Burlington, Iowa, in July of last year, have been supplemented by a second series this year; the two series together being by far the most complete tests of the kind which have ever been made. The results demonstrated that only air-brakes are adapted to the requirements. The prominent part of this year's tests was that taken by electricity as an actuating agent for applying the brakes, with results showing great benefit from its use, both in quickness of stop and in avoiding the dangerous shocks which result from quick stops with long trains. The electric application being absolutely simultaneous throughout the train, no shock whatever results. The occasional failures of the electric apparatus during the test indicated that further improvements are still needed, but as electricity simply supplements the air, which acts as usual in case of an electric failure, the probability seems strong that such electric application will be a feature of the train-brake of the future, while a percentage of efficiency was shown in this year's test, much greater than was ever shown before. As a safeguard for human life, rapid progress has been made toward the introduction of automatic freight-car couplers. The Burlington brake tests of this year and last show that it was on the whole decidedly beneficial to eliminate loose slack between trains which has tended to exclude couplings of the link and pin type, and the final step has now been taken by the formal adoption by the Master Car Builders' Association of the Janney hook coupler and others of the same type coupling with it as standards of the association, by a vote of 33 to 14.

STREET RAILWAYS.

The entire service of street railways was for many years by the means of horses, and we quote as to the cost of working the following returns taken from the sixteenth annual report of the Massachusetts Board of Railroad Commissioners: Highland, Lynn and Boston, Metropolitan, Middlesex, and South Boston; number of horses owned, 6,158; number of miles run, 11,287,196; number of passengers carried, 68,196,776; average number of passengers carried per round trip, 43.4.

From the above it appears that the stable average daily distance traveled by the above horses equals 10.04 miles.

The average number of passengers per round trip being 43.4, per single trip equals 21.7. Averaging them at 140 pounds, equals 3,038 pounds. Add weight of car, 4,800 pounds, equals 7,838 pounds.

With the great extension of street roads there have been found great inconveniences in this horse service, not only in the cost, but in the location of immense stables within populous neighborhoods. The usual traction force has been reckoned to be about $\frac{1}{8}$ per cent. in movement, and from 6 to 7 per cent. in starting on level grades. This will afford us a means of comparison between different forms of motors.

Although the cable road was used on the London and Blackwall Railroad for many years and for heavy trains, it was superseded by the locomotive, but it has of late years been revived in this country for the distribution of city travel and with great success.

Chicago has 20 $\frac{1}{2}$ miles of cable road in operation and 22 under construction; Cincinnati, 8 miles; Kansas City, 4 miles in operation and 30 under construction; New York City, 10 $\frac{1}{2}$ in operation; Philadelphia, 18 miles; St. Louis, 6 miles; San Francisco, 33 $\frac{1}{2}$ miles now in use; Melbourne, Victoria, has several miles; London, 3 miles, and four years ago a road was built in New Zealand. The first cable road in San Francisco was opened in 1873. This was the famous "Clay Street Hill Cable Road," where the grades were so steep that property was almost valueless. The cables had no trouble with the grades, 17 feet in 100, where horse power was useless and the road was an immediate success.

Mr. W. H. Paine, M. Am. Soc. C. E., has furnished me with the following facts in regard to the cable on the Brooklyn Bridge which he laid: "The practicability of applying cables to the hauling of large heavy passenger cars in trains at considerable speed with shorter headway, greater regularity and less danger from accident than any other method known is here demonstrated.

"The durability of the cable, and of the grips and dies has been here so great as to remove a most serious objection to cable traction.

Speed of cable, 10 miles per hour.

Length of cable, 11,000 feet.

Size of cable, 1 $\frac{1}{2}$ inches in diameter.

Weight, 3 $\frac{1}{2}$ pounds per lineal foot.

"The first cable was taken out last November, after having been in use three years and 41 days, having hauled 1,675,790 cars, 48,108,567 passengers, or 22,196,436 tons. The heaviest cars weigh 16 tons when empty, the heaviest load of passengers about 10 tons. The lightest cars weigh 11 tons when empty. Three cars are now hauled in one train. Shortest headway about 1 $\frac{1}{4}$ minutes. More than 100,000 passengers have been carried in one day. The grips will last for years with few repairs. The dies or lining of the grips last more than four months, sometimes exceeding five months. The speed of the cable, which is 10 miles per hour, could be increased, but without increasing the carrying capacity of the road."

ELECTRIC RAILWAYS

for street passenger traffic seem now to be a fixed fact. In Europe electric street railways are now carrying at the rate of 3,000,000 annually, and probably a little in excess of that number here, and they are extending. The first built was in Berlin, Germany, 1881, 1 $\frac{1}{2}$ miles in length. In this country they date from 1885. The following are the places in which they are established in this country. Baltimore, Md.; Los Angeles, Cal.; Port Huron, Mich.; Windsor, Canada; Detroit, Mich.; Appleton, Wis.; Scranton, Pa.; Denver, Col.; Montgomery, Ala. In all but one of these, the dynamo is driven by a steam-engine, but in Appleton, Wis., there is a road of $\frac{1}{4}$ miles, where water-power is used. You may recollect that an eminent divine once remarked as an evidence of design in the works of the Creator, that great rivers were placed near great cities. It were fortunate for the purpose of lighting and heating if great water-powers were placed in the vicinity of large populous districts. It has not yet been sufficiently decided how far power can be carried by means of electricity, nor the size of the conductor and the loss in conducting it. With the short roads now in operation it has been said that the percentage of effect on the car is 50 per cent. to 55 per cent. of that of the steam-engine providing the power. In this respect it is superior to the cable, which is fast superseding horses.

Few of the present engineers recollect the experiment of the old atmospheric railway of Samuda, which ran from Dublin to Kingston, about 1 $\frac{1}{2}$ miles, successfully for many years; and was later tried in a larger way from London to Croydon and from Paris to St. Germain. It failed and was superseded by the locomotive. It may be that for a moderate distance the atmospheric road may become practicable, but for the present our hopes of a successful motor, especially for city and town roads, are based on electricity. So much at least has been directed to this subject, not only with reference to power, but to light and heating, that a new branch of engineering has sprung up and has inaugurated itself into a society like our own as the American Institute of Electrical Engineers. From our knowledge of them and their claims I feel satisfied that they are to be a worthy branch of engineers. In our own country capitalization in electrical districts, telegraphic, telephonic, electric lighting, and electric power, amounts to a sum of at least \$350,000,000. There are in America about 700,000 miles of telegraphic wire; last year 32,000,000 conversations were held on the telephone; there are over 150,000 arc lamps, and incandescents verging on a million, and at least 15,000 electric motors for fans and sewing machines.

BRIDGES.

The first Howe truss was built across the Connecticut River at Springfield, Mass., in 1840. It was a wooden bridge with double intersections. Smaller bridges had been built in the same line of road, but this was a very important bridge at the time. Howe was a carpenter and the bridge was designed by average judgment, and the construction of one bridge made the precedent for another. Engineering science was not then applied to the calculating of stresses. Undue confidence in the form of truss, and the successful construction of many bridges in wood led to the Ashtabula accident. The strong desire for the construction of iron bridges at minimum cost, and the high price of iron, led to the construction of weak designs of this material, and postponed its adoption for many years. With the reduction of the price of iron, and a better understanding of the principles of construction, iron bridges have almost entirely superseded the wooden ones.

The forms have been calculated and tested by years of practical use, and they are furnished by engineering bridge companies in lengths to suit, and guaranteed to resist the stresses required. The finding of the jury in the Bussey Bridge disaster on the Boston & Providence Railroad is acknowledged to have been just, but this is not likely to occur with bridges as at present furnished, and subjected to careful inspection on the part of railroads. The limit of span has not yet been reached, nor perhaps the admissible height of skeleton piers, nor any form of truss or suspension established as the best. Cantilevers, from the ease of their erection without false works, are largely used, but esthetically in form they do not compare with the arch; yet extended use and knowledge of their "fitness for function" will soon reconcile one to the form.

GAS ENGINEERING.

Much has been done by improvements in mechanics and chemistry to increase the product of gas and reduce its cost. Water-gas is largely manufactured, and its uses extended in forging and welding. It is to be hoped that it may be distributed by mains throughout cities for the purposes of heating buildings and cooking. And although from experiment it has been demonstrated that water-gas has but 65 per cent. of the thermic value of the coal from

which it is manufactured, yet when the cartage and the storage of coal is taken into account, together with the curtailing of hours of consumption by gas to the time necessary for the purpose, and the economy in the application of gas, there seems to be a fair presumption that, sooner or later, water-gas will be used for heating and cooking. In fact, from the great waste of heat in lighting by gas, and its cost, there perhaps might be some economy in converting the heat of water-gas into power through an engine, and into light by a dynamo, rather than directly by carburetted hydrogen into light.

SANITARY ENGINEERING.

Of late years this branch of the profession has been recognized. It embraces the construction of sewers, the removal of sewage, and its purification, or rather offense from it, and the plumbing and heating and ventilation of houses. The construction of sewers has long belonged to the department of hydraulic engineering, sometimes by the combined and sometimes by the separate system, the general aim being to remove sewage speedily from the town or city, and to points remote from settled neighborhoods, and, if possible, discharge it into a large body of flowing water. Of the offense in the matter of smell from sewage, there is no doubt; but that it is so dangerous to life and detrimental to health as is often claimed, I have just doubt from a large experience and from evidence of experts before court.

I have said in the earlier part of my address that the engineer is born like the poet, sculptor, painter or any other artist, but that he is cradled on palpable material and nursed on facts, not metaphysical ideas, of "I think, therefore, I am," or even the syllogism of the second order of differences, "I think, I think, therefore I think I am," but I am an engineer, and must think, and work. It is not necessary for him that he should believe either in the corpuscular or the wave theory of light, or in the atom whose weight is 1, the first unit in the 22 place of decimals of a gramme, or that pressure is due to the immense velocity of atoms in motion, or that even bodies fall by attraction of gravitation or some later discovered force. If these present theories enable him to recollect facts, they serve their purpose. It is sufficient for the engineer to know the laws of force, to be able to resist or use them; $v = gt$ or $v^2 = 2gs$ supplies him with the laws of gravitation even if he cannot understand the why.

The works of the engineer involve higher responsibilities than any other profession; he is to build, suitably, with materials at his disposal, solidly and securely for the prevention of accidents and for the protection of passengers, and economically in cost. He is to draw from his own and the experience of others, but he should not try experiments at another's cost, without a full understanding with the parties employing him.

As an expert, he must testify to facts, and the party who retains him must accept his facts, as they may be brought out in evidence, whether they are for or against them. It were better that the expert were attached to the court and not retained by either plaintiff or defendant. The construction of the law depends on the ruling of the judge. The value of the facts, from his point of view, should be settled by the engineer. As an umpire between the capitalist and contractor, his decision should be impartial, and if, by his own error, either party has been put to an unnecessary expense, acknowledge the fault, and, as far as possible, remedy it, but where such responsibility is taken, the price should be commensurate.

From the position of the engineer as umpire between the capitalist and contractor, and his large employment and familiar intercourse with mechanics and laborers, he would naturally be the proper party to adjudicate in disputes between labor and employer, and perhaps it would be so were the present troubles between labor and capital. But the strife is to see whether labor cannot support another class; chapters, president, officers, walking delegates and the like. These troubles come up in every country, and in every age; they are like the measles, whooping cough fever, cholera, in the microcosmi. Ours, at present, is an imported disease; the diagnosis of the suppression of the individual, of boycott, etc., are entirely un-American. It is not our own labor, but the imported labor that is striving, not for a chance for labor, but rather for a life without labor. There is no country in the world where labor is so well paid, so well clothed, well fed and well housed. We have taken in an immense immigration, and still are, and have endeavored, by making them citizens, to assimilate them rapidly into our body corporate. This should be a question of time. It is a common phrase to say one has bitten off more than he can chew. How much more sad our case when we have swallowed more than we can digest! The great panacea seems to be land; some of us have worked land, and think if land were given to us instead of bread it would be the gift of a stone, but, if properly applied, it might relieve our present labor trouble. Let every immigrant be sent at once into the country and furnished a cabin and ten acres of land, without tax, as there is to be hereafter no titles to land, and support himself and family ten years on the land. At the end of that time the majority would prefer the work and wages of a day laborer, especially in the city, and all would be better citizens. Syndicates of labor are as proper organizations as syndicates of capital or of employers, and syndicates can only be met by syndicates. Properly organized, they are not expensive and are efficient; but individuals should have perfect freedom to do as they please with their labor or capital, within the limits of law, and must be protected by law and a healthy public sentiment.

The Secretary has furnished the following statement of the present (June 22) membership of the Society:

	Resident.	Non-Resident.	Total.
Honorary Members.....	3	5	8
Corresponding.....	3	3	6
Members.....	161	632	793
Associates.....	11	34	45
Juniors.....	28	92	120
	201	766	969
Fellows 64, of whom 6 members are included above, leaving.....			58
Subscribers to the Building Fund, 140, of whom 90 are entered in one or other of the above classes, and deceased, leaving.....			50
Total now connected with the Society.....			1066

Whence are we to draw our future membership to maintain the ranks of our society? In answer, a distinguished professor and engineer has kindly furnished me the following statistics:

"There are in the United States 360 colleges and universities, which, besides classical and other courses, teach technology, and have given diplomas on technical professional subjects to 1,058 graduates. There are besides 49 schools, working under the 'Land Grant,' with 593 teachers and 4,644 students, of whom about 600 were technical graduates. In addition to these there are 39 private technical institutions with nearly 300 teachers and over 7,000 students, 800 of whom received technical diplomas. Statistics of this kind are very difficult to obtain, but it may be said that our higher schools of science turn out about 2,500 men per year, and of these about seven per cent. are engineers."

It becomes us, who are conversant with the needs of our profession, to advise that before entering our technological institutes, students should have a good school training, such as is required in entering classical universities, and that within the institutes they shall know, not only what to learn, but also how to learn. Then in their outer world progress, they may know how to accumulate knowledge useful to themselves in their profession, and reciprocate for the information and pleasure of those with whom they are thrown in contact.

In the earlier part of my address I claimed for the origin of our name, Engineer, *le genie*—genius; but genius, inborn, is derived from the Greek *gune*, woman, and I trust that there is no profession which has a higher respect or greater love for that name than our profession, whether as mother, sister, wife, or companion in the halcyon days of youth, or, in maturer years, our origin, protection, comfort, and inspiration. We trust that they will always attend our annual outings, intended not only for interchanges of views in matters of our profession, but also as a relief from business, a union for the establishing of a more general acquaintance, and cementing the bonds between the members of the A. S. C. E.

THROUGH two unaccountable blunders on the part of the types, which were not detected until a portion of our edition had been printed, we were made to say, in our report last week of the banquet to members of American Society Civil Engineers at Hotel Kaaterskill, that the number of covers laid was 1,300, while the actual number was 130; and further on the names of two of the toasts and those who responded were curiously mixed.

The toast, "Our Past Presidents," was responded to by General George S. Greene, and that entitled "The Pioneer in Engineering" was responded to by Mr. W. J. McAlpine.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

A NEW HOISTING-ENGINE.

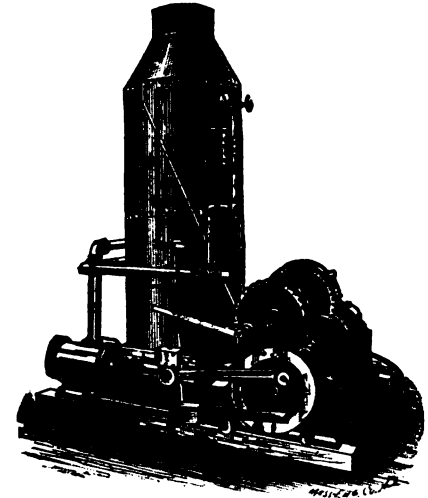
WE herewith present a new hoisting-engine, the invention of Mr. Irving G. Hooper, and manufactured and for sale by Mr. Alexander Traud, of Newark, N. J.

It is a friction-clutch machine, intended for the rough usage to which such machines are ordinarily subjected, and is made with as few parts as is consistent with such a machine.

The bed of the machine, and all the journal-boxes, are cast in one piece, so as to avoid the use of bolts or other fastening devices to hold parts together that are better as a whole. This form of construction also insures the parts remaining in line, which is an important item in an apparatus subject to such a constant jar as a winch.

A special point of its construction, however, is the friction-clutch, the detail of which is partly shown. Two long segments, which form a friction-ring, are forced outwards by means of four toggles, which hinge into them and which form the struts, the inner ends of which are engaged in like manner with two friction-blocks, which

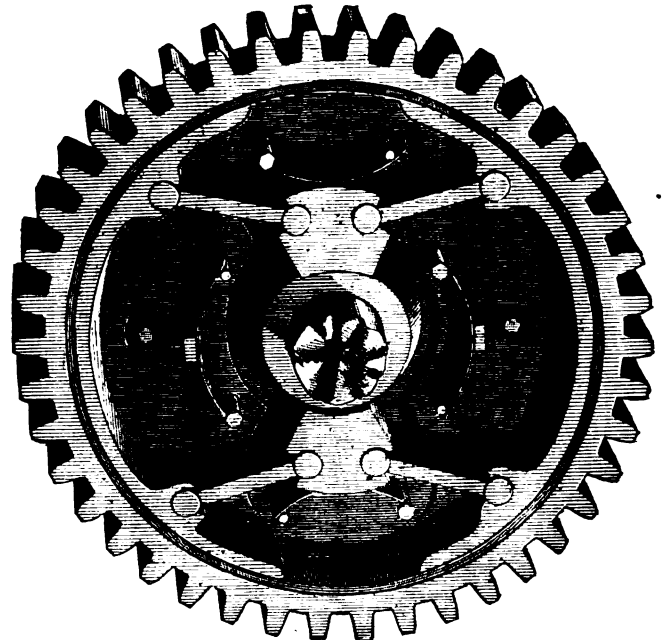
engage the friction-cone. The arbor of the windlass is hollow, and through it works a smaller shaft that gives motion to the friction-cone, by means of hand-lever shown in the front of the elevational illustration. The cone is fastened to the hollow arbor by a key which passes through both cone and arbor, having an inch or so lateral movement in the arbor. The small shaft, which is simply a loose rod, comes against the key when pushed into the arbor by the hand-lever; thrusting the cone



against its friction-blocks, which in turn give thrust to the toggles. The hand-lever, as before intimated, is not attached to the centre rod of the arbor, but engages it by a short screw of coarse pitch, which works within a nut and cap on the side of the windlass-journals. A quarter of a revolution of this screw gives the cone a forward motion of one-half inch and admits of almost unlimited pressure between the surfaces. It also admits of instantaneous relief when released.

The four springs shown in the detail take up the slack motion on the friction-gears.

A sheet of vulcanized fibre is interposed between the friction-surfaces at the rim of the wheels, which can be



readily removed and renewed, as it requires no festening being simply laid into place.

The machine may be changed from double to single gear in a few minutes by unskilled labor. By loosening the cap-screws the caps may be thrown back on the hinges shown in the engraving, in which position they form brackets that hold the gear-shaft out of place, when the machine may be run with single gear direct from the main shaft. This is to provide for one machine doing light or heavy work.

At a recent trial-trip of the new steamer "New York," of the Day Line to Albany, the rate of speed attained was 24 miles per hour. It is claimed that the speed of the "Mary Powell" is 25 miles per hour, but a well-informed professional man stated that her speed is less than 22 miles per hour.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITION.

THE Board of Public Lands and Buildings will receive plans and specifications at any time before August 1, 1887, at 2 P. M., for the Hospital for the Incurable Insane, at Hastings, Neb. Building to be 3-story brick, with stone basement, and not to cost over \$75,000, including steam-heating and plumbing. The right is reserved to reject any or all plans submitted. G. L. Laws, Secretary.

PORTLAND, ME.—F. H. Fassett, architect, of Portland, Me., has been selected as the designer of the Soldiers' Monument at that place.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE CONTRACTING ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 173-174-175-176.

WATER, SEWERAGE, ETC.

JEFFERSONVILLE, KY.—The firm of Samuel R. Bullock & Company, of New York City, offer to lay ten miles of pipe, and place 10 plugs, ten to the mile, for fire service. They also offer free water to the city for flushing streets and alleys, and for the use of a given number of fountains to be erected at the city's cost.

FORT SMITH, ARK.—The City Council has received a report and estimate for a system of sewerage, placing the cost of the main sewer and flush-tanks at \$17,500, and the cost of laterals at \$10,000.

FAIRFIELD, ME.—The Waterville Water Company has made a proposition looking to supplying this place with water.

ALLEGHENY, PA.—The Water Committee's report to Council will recommend the establishing of a filter-plant.

MOUNT HOLLY, N. J.—Steps are being taken to organize a new water company here.

PITTSBURG, PA.—The construction of the Negley Run sewer has been abandoned.

SYRACUSE, N. Y.—Mayor Burns has vetoed the ordinance granting a franchise to the Salmon River and Onondaga Water Company.

LITTLE ROCK, ARK.—An ordinance granting a franchise to the Arkansas Water Company is now pending in the Board of Aldermen.

NEW ALBANY, IND.—The Water-Works Company has issued \$50,000 in bonds. The funds derived from the sale of the bonds are to be applied to the laying of a twenty-inch main from the reservoir on the Knobs up Spring to Vincennes Street.

MEMPHIS, TENN.—The Artesian Water Company offers to construct a system of water-works. The communication is signed by R. C. Graves, President; John Johnson, Chairman; Napoleon Hill, John W. Dillard, S. H. Brooks, and W. T. Bowdler. They propose to furnish pure and wholesome water for both public and private purposes.

MILLBURY, MASS.—has petitioned the Worcester Council to furnish them a supply of water from Worcester mains.

GRAND RAPIDS, MICH.—The Supreme Court has dissolved the injunction which the city obtained to restrain the Grand Rapids Hydraulic Company from laying pipes in the streets, and it is believed work on the new water-supply will begin very soon.

JERSEYVILLE, ILL.—The contract for building water-works has been awarded to G. C. Morgan, of Chicago, at \$29,988.

SLEEPY EYE, MINN.—A complete system of water-works will be put in, bonds already having been sold.

ST. CLOUD, MINN.—E. T. Sykes & Co., of Minneapolis, have been awarded contract for extending sewerage system for \$10,000; work to be done in sixty days.

PLYMOUTH, MASS.—A town meeting July 7 voted to adopt a plan for a water-supply, proposed by the Water Commissioners, which is to divide the supply into a high and low service, the business portion of the town being furnished with the natural gravity head of about forty-five feet, and the high levels of the town will be supplied by the present pumping service on separate mains.

CATONSVILLE, MD.—The Catonsville Water Company have elected the following officers for the ensuing year: President, Joseph M. Cone; Secretary, Melvin Cone; Treasurer, Dr. C. G. Macgill; Directors, Joseph M. Cone, Melvin Cone, Charles D. Baker, John Hubner, and Dr. C. G. Macgill. \$23,000 of stock has already been subscribed. It is contemplated to extend the supply of water to Carroll, on the Frederick pike, some distance below, in the direction of Baltimore.

FLUSHING, N. Y.—The U. S. Government has accepted the proposition of the Trustees of this village to supply the military post at Willets' Point with water. The work is to be completed by the 1st of November next, this village carrying the mains to the Government

lines near Garrison's Hotel at Little Bayside—the Government laying the pipes on the post, and paying \$5,000 per year for a daily supply of 60,000 gallons for two years, and thereafter \$3,000 per annum. For any excess of 60,000 gallons used the Government is to pay extra by meter measurement.

CHICAGO.—An ordinance has been drawn authorizing the Commissioner of Public Works to advertise for bids for building a new tunnel, also new water-works on the South Side. Rudolph Hering, Consulting Engineer, and Mr. Artington, City Engineer, favor the scheme.

WEST BAY CITY, MICH., is agitating the question of sewerage.

SAULT STE. MARIE, MICH., will have a sewerage system.

MARLETTE, MICH., will vote July 28 on the question of building sewers.

MILWAUKEE.—Water-pipes will be laid on the following streets: Howell Avenue, from Lincoln Avenue to Clarence Street, 17th Ward; Farwell Avenue, from Maryland Avenue to North Avenue; Twenty-eighth Street, from Cedar Street to Watertown Road; Fifteenth Street, from Villet to Galena Streets; South Pierce Street, from Clinton to Reed Streets; Arlington Place, from Brady Street to Warren Avenue.

SAN BUENAVENTURA, CAL., has voted to issue \$200,000 of city bonds for building sewers.

MACON, GEO.—The contract for a supply of water for five years was awarded to the Macon Gas and Water Company, and the contract signed by the Mayor July 9.

MANKATO, MINN.—The city is advertising for proposals on 6-inch and 10-inch pipe sewers. A special election will probably be held soon to vote on the issue of bonds for a water-supply, general sewerage system, and park improvement. A report on sewerage has been presented by F. S. Blodgett.

CHRYVENNE, WYO.—Steps will be taken to enlarge the water-supply. Address Mayor River.

READING, PA.—The Water Board has concluded to put in two filters at a cost of \$30,000. They will purify 2,000,000 gallons daily.

WATER-WORKS will be built at the following cities and towns: Independence, Cal.; Marlin, Tex.; Wilton, Iowa; Griffin, Geo.; Chardron, Tex.

OSAGE CITY, KAN.—The Osage City Water Company has been incorporated; Thomas J. McKee, George B. Iman, William F. Iman, of New York City.

BAKERSFIELD, CAL.—A scheme is under way to construct irrigation reservoirs on Kern River and Walker Basin Creek, and a canal to convey the water to the valleys.

FRANKLIN, ME.—Town meeting has indefinitely postponed the consideration of the proposition of the Farmington Water Company to furnish a supply of water.

TORONTO, CAN.—Tenders will shortly be called for the construction of a large sewer in the north-east part of the city known as the Rosedale Creek. It will be one of the main intercepting sewers in the final scheme of the main drainage of the city. Another large intercepting sewer, over a mile in length, will also be commenced this year on Blair Street; it will connect with the Garrison Creek sewer, and drain about 100 acres. Rosedale sewer will drain about 100 acres. City Engineer Sproatt, the chairman, and some members of the Committee on Works, are visiting the larger cities in the Union to look into points connected with roadways, foot pavements, sewers and other matters connected with municipal engineering.

LEBANON, PA.—Mr. Harvey Tyson, of Reading, has been engaged to furnish estimates and superintend the temporary water-works to be constructed east of this city.

PROVIDENCE, R. I.—Mayor Robbins sends a communication to the City Council urging the speedy taking of steps to carry out the plan of sewerage presented by the City Engineer.

COUNCIL GROVE, KAN.—Inman Bros., of New York City, are building water-works for the company, having a 25-years' franchise from the city. There will be 4 miles of pipe, 40 hydrants, with stand-pipe. The water will be obtained from a well.

MILWAUKEE, WIS.—The Milwaukee Water Works Construction Company has been incorporated by George S. Bartlett, George P. Miller and Henry P. Ellis. The capital stock is \$300,000, divided into shares of \$100 each, and the purposes for which the corporation is organized are the building, renting, operating, purchasing or selling of water-works and gas-works, together with all supplies needed in the construction, extension or repair of the same, together with the manufacture of pipe generally and pipe for use in water and gas works.

APPLETON, WIS.—The City Council has declared the contract with the Water-Works Company void.

CHICAGO.—On July 11 the Aldermen decided that the water-tunnel should be constructed. It will be about 4 miles long.

TRENTON, N. J.—The City Council has passed an ordinance providing for the construction of two intercepting sewers. This is regarded as a beginning to carry out the plans prepared some time since by Mr. Rudolph Hering, now of Chicago.

MONTICELLO, FLA.—The City Engineer has made plans for a sewerage system.

PARIS, KY.—Address W. P. Chambers about water-works here.

ALBANY, GEO.—Water-works will be built here. Address Robert Hobbs and John A. Davis.

ELSINORE, CAL.—The Elsinore Land and Water Company filed articles of incorporation recently, to buy, sell, own, and control water rights, lands, etc. The principal place of business is to be at Elsinore, and the corporation is to exist fifty years. The capi-

tal stock is \$110,000, of which \$103,220 has been subscribed. The incorporators and the directors for the first year are, J. D. Vocum, N. G. Vocum, J. B. Young, M. C. Starbuck, and Ira S. France.

MILLEDGEVILLE, ILL.—Address Samuel Walker about water-works here.

ALLEGHENY, PA.—The committee on water has decided to have a reservoir built on the side of one of the intrenchments built in the Gettysburg campaign days of 1863.

MONTROSE, COL.—Water-works surveys are being made.

ST. CLOUD, MINN.—A sewerage system has been planned by F. T. Todd, City Engineer.

LOS ANGELES, CAL.—Address Freeman G. Teed, about sewers to be constructed here.

PORT HURON, MICH.—See our "Proposal Column" in regard to pumping engines for the city.

SPARTANBURG, S. C.—Messrs. Moffett, Hodgkins & Clarke, of Watertown, N. Y., propose to build water-works at this place shortly.

GOLDSBORO, N. C.—The water-works for this city will be built by Messrs. Moffett, Hodgkins & Clarke.

WEATHERFORD, TEX.—This city is contemplating the erection of water-works.

CHICAGO.—We have noticed above the definite action in favor of a new water-works tunnel. This will involve a new pumping plant, the site of which is now being discussed.

AUSTIN, MINN.—Plans and specifications are now being prepared for bidders on water-works.

FLORENCE, KAN.—The Cypress Water-Works Company has been organized. Andrew Brown, President, M. B. Shelton, Vice-President, and J. B. White, Secretary and Treasurer.

LENEX, MASS., is considering the raising of funds to complete the sewer system.

LANCASTER, PA.—The city has selected the plan No. 2, presented by J. J. R. Croes, C. E., of New York City, which provides for moving the water-works further up stream.

BEAVER DAM, WIS.—Incorporated is the Beaver Dam Water-Works Company; J. W. Mead and M. Warren, incorporators.

GAS, STEAM, BUILDINGS, ETC.

DAPHNE, ALA.—W. Stewart will receive bids for building a court-house and jail at Daphne, Ala., until July 25.

AKRON, O.—Proposals are to be advertised for heating apparatus for the Second Ward School Building.

ANN ARBOR, MICH.—A company will drill for gas.

YPSILANTI, MICH., will have electric lights for street lighting.

ALTOONA, PA., will receive proposals for lighting the streets until August 1.

WEATHERFORD, TEX.—The City Council is negotiating for the building of gas-works.

BIRMINGHAM, ALA.—Incorporated is the Alabama Automatic Water-Gas Company, to manufacture gas under the Sloper patents. George C. Kelley, C. C. Ashe, Amzi Godden, W. S. McConnell, Fred Slom, are among the directors.

READING, PA.—A charter has been granted to the Reading Steam Heat and Power Company, with a capital stock of \$100,000, all of which is already taken. The company will shortly commence laying mains.

LINDSEY, O.—The Lindsey Natural-Gas and Oil Company has been incorporated and has given a contract to Ederburn & Boynton to sink a gas-well.

NEW LEXINGTON, O.—The village has contracted with the Union Electric Construction Company, of New Jersey, for electric-lamps on the Thomson-Houston system.

ROCHESTER, PA.—The Baden Natural-Gas Company, of Pittsburgh, has contracted to furnish natural-gas to the Rochester Heat and Light Company for Rochester, Beaver, and Bridgeport.

JAMESTOWN, DAK.—The Council has decided to advertise for bids for electric-lights, giving the successful bidder an exclusive franchise for ten years, and the privilege of using the streets for another ten years. The city will expend not more than \$800 per year for street-lighting at the start.

COLUMBUS, O.—Incorporated are the Newark Electric-Light and Power Company, capital stock \$20,000; the Scioto Natural-Gas and Oil Company, increase of capital stock from \$5,000 to \$50,000.

AUSTIN, TEX.—Organized is the Austin Water, Light and Power Company. It will add to its electric light plant.

RAILROADS, BRIDGES, CANALS.

DURAND, MICH.—Fast Saginaw capitalists have formed a company to build a railroad to this place.

CHIPPewa FALLS, WIS.—The preliminary survey of the Chippewa Falls and Ashland Railway, southern end, is being pushed. T. C. Pound, L. C. Stanley, and Colonel Rush are at Ashland to start a surveying party from there. One of the main objects of this road is to open up a timber line, as it will traverse a heavy pine region, much of which is too far from the main streams to be accessible to them.

ROCHESTER, N. Y.—Incorporated is the Rochester Electrical Railway Company, to build street railways; Asa T. Soule, James B. Perkins, H. D. McNaughton, C. B. Judson, Bernard P. Smith, Henry Brinker, Directors.

RICHMOND, VA.—The stockholders of the Virginia Construction Company will meet here, July 10, to re-organize for the building of the Tennessee Midland Railroad. R. H. Temple, Chief Engineer, is already advertising from the Memphis, Tenn., office of the Construction Company for bids on graduation, masonry, bridges, trestles, ties, etc., for 135 miles of road. The date of opening is July 25.

CHICAGO and Gulf Air-Line Railroad will be built. C. C. Werrick, of Chicago, is president.

RAILROAD.—The Chicago, Jefferson City, Girard, and El Paso Railroad has been incorporated at Topeka, Kan. The principal office will be at Girard, Kan. Hugh McMillan and W. Gow, of Chicago, James B. Rice and S. W. Cox, of Jefferson, Mo., are among the directors.

LAWRENCE, MASS.—The committee on Union Street Bridge will reject all bids for rebuilding the stone piers.

ST. PAUL, Black Hills, and Pacific Railway will be built at once. Address S. P. Jumper, President.

ST. LOUIS, MO.—Merchants' Bridge and Terminal Company will soon begin work on the bridge over the Mississippi. Address Major Rainwater.

BOSTON.—Proposals will soon be advertised for a \$500,000 bridge over the Charles River, between Boston and Cambridge.

CONCORD, N. H.—A bill now before the New Hampshire Legislature provides for the incorporation of the Vermont and New Hampshire Railroad, backed by the Central Vermont. Gregory Smith, President of the latter road, is advocating the former.

MERIDEN, CONN.—Surveys for the Waterbury Meriden Railroad are progressing and work will soon begin on the line. Joseph Hugh Crawford is Chief Engineer, and V. T. Valdez, of Meriden, First Assistant Engineer.

JACKSONVILLE, FLA.—The Jacksonville and Fort George Island Railroad will soon be built. Address Captain Charles Holmes.

SAVANNAH, GEO.—A bill is before the State Legislature incorporating the Savannah, Macon, and Birmingham Railroad.

CHADSVILLE, N. J.—The Cumberland County freeholders have decided to erect a new bridge here.

BURLINGTON, IOWA.—A company with a capital of \$300,000 has been organized at Burlington for the purpose of building a wagon bridge across the Mississippi river.

HARRISBURG, PA.—The Carbon, Schuylkill, and Western Railroad Company, with a capital of \$200,000, and the Clearfield and Allegheny Railroad Company, with a capital of \$3,000,000, were chartered July 12. They are under the same control and are said to be a part of the Baltimore and Ohio and Lehigh Valley scheme to run a line from New York to Pittsburgh. The President of both companies is John J. Summers, of Philadelphia. The directors are, Edwin L. McConoghie, Thomas F. Baltz, W. F. Hixson, William A. Baker, H. C. Lincoln, and E. G. Price, also of Philadelphia. The first road with its branches is 325 miles in length, and will start from a point in the southerly line of Carbon County, and the terminus will be at or near Blairsville, in Indiana County. The other road will be 125 miles in length, and will start near Gazzam station, in Clearfield County, and will extend to Allegheny City.

TOPEKA, KAN.—Incorporated is the Denver, Russell Springs, and South-western Railroad to build several lines of road. D. M. Richardson, of Denver, Col., James Warden, of Frankfort, Ky., J. E. Hilt, of Russell Springs, Kan., are among the directors.

RAILROAD.—The Memphis, Kansas, and Western Railroad is now being surveyed from Cherryvale, Kan., to Neosho, Wis. R. M. Whitman is head of the surveying party.

BAKERSFIELD, CAL.—A street railroad will be built here at once.

SAN DIEGO, CAL.—The Escandido and El Cajon Railroads will be built at once.

JAMESTOWN, DAK.—Surveyors of the Minneapolis and Pacific Railroad are running a survey for the extension of the road from Foreman, Sargeant County, North-west. It will probably cross the Northern Pacific, between Eckleson and Spiritwood. The surveyors are ten miles south of Sanborn at Waza. Work is reported to have commenced on the east end.

FLUSHING, L. I.—The Flushing and College Point Street Railroad Company has obtained its franchise for a street railway from Sandford Avenue and Parsons Avenue to the city line. The road must be in operation by September 30, 1888. Ex-Supervisor Joseph Dykes is president.

ASBURY PARK, N. J.—Incorporated is the Keyport and Manhattan Street Railway Company. The directors are Daniel W. Pugh, John S. Pugh, Frank D. Russell, of New York; George D. Keeler, of Brooklyn; William H. Reed, Thomas K. Brown, John D. Sprowl, Dr. J. Arrowsmith, Charles H. Whitlock, of Keyport, and David A. Bell, of Matawan.

HARTFORD, CONN.—Ex-Speaker James Husted will become President of the Hartford, Pennsylvania, and Western Railroad Company, whose road is destined to form important links with the New York Central, Boston and Albany, Harlem, Pennsylvania, Jersey Central, Lehigh Valley, and other railroads, to be reached by the 270 miles of constructed or laid-out road. The road will be extended to the Poughkeepsie bridge and connect with the great coal roads.

FLORENCE, ALA.—The Memphis and Charleston Railroad will build a bridge over the Tennessee River near here. R. B. Pegram, of Memphis, is general superintendent of the road.

TRENTON, N. J.—The Freeholders of Mercer County have awarded the contract for an iron bridge over the Delaware River to the New Jersey Steel and Iron Company.

KNOXVILLE, TENN.—The City Council has decided to subscribe \$500,000 to the stock of two new railroads to be built to this city. The sum of \$275,000 will go to the Knoxville Southern Railroad to be built in connection with the Marietta and North Georgia Railroad, making an air-line from Knoxville to Atlanta, Ga. The sum of \$225,000 will go to the stock of the Powell's Valley Railroad to be built from Knoxville to Cumberland Gap and to connect with the Louisville and Nashville and Norfolk and Western Railroads in Kentucky.

FORT PLAIN, N. Y.—The Fort Plain and Richfield Springs Railroad Company has been incorporated. The road is to be constructed from Fort Plain in a south-westerly direction to Richfield Springs, distance thirty miles. The directors are: William Clark, Charles S. Tanner, Willis F. Diefendorf, Charles Zeilly, John D. Wendell, David E. Dunn, David G. Hackney, Fort Plain; Abram Tilyou, L. G. Youngs, Van Hornesville; S. H. Elsworth, Starkville; T. K. Proctor, Elias B. Wetherbee, Richfield Springs; Stephen Stewart, Springfield Centre.

LITTLE ROCK, ARK.—Articles of association have been filed by the Little Rock and State Line Railroad Company for a road to be built from Little Rock to a dividing line between Arkansas and the Indian Territory. The road will pass through the counties of Pulaski, Saline, Garland, Montgomery and Polk. The incorporators are: John D. Adams, S. B. Adams, J. F. Boyle, J. R. Miller, of Little Rock; E. W. Rector, and J. M. Keller, of Hot Springs.

SAN FRANCISCO, CAL.—Articles of incorporation of the new road through Capay Valley have been signed by the Directors who will be as follows: C. F. Crocker, W. V. Huntington, N. S. Smith, T. Hopkins, F. S. Douthy, and E. H. Miller. This road is to run from Madison, Yolo County, to Rumsey's at the head of Cache Creek.

ST. PAUL.—The contract for building the initial line of the new electric motor to South Park, a new suburb, has been let to Mr. Laurence, Room 61, German-American Bank Building, St. Paul.

MINNEAPOLIS, MINN.—Incorporated is the Mississippi, Faribault and Northwestern Railroad Company, to operate a road from some point in the southeastern part of Minnesota, on the Mississippi river, northwestwardly via Faribault to some point on the western boundary of the State, intersecting the St. Paul, Minneapolis and Manitoba Railroad at or near Willmar, with such branches as the board of directors may consider necessary. Principal place of business, Faribault. Incorporators: Hudson Wilson, S. L. Crocker, T. B. Clement, G. W. Batchelder, A. J. Mennell, M. J. Sheeran, F. W. Friuk, C. C. Perkins, George A. Weston, A. E. Haven, George Tietson, J. C. N. Cottrell, W. E. Blodgett, E. N. Leavens, John Hutchinson, F. A. Bean, J. R. Parrshall, George Robinson, E. H. Lovhed, D. Cavanaugh, T. J. McCarthy, A. W. McKinstry, E. M. Leach, G. W. Wood, F. A. Theopold, all of Faribault.

RAILROAD.—The Minnesota and Northwestern Road has three surveying parties in the field between Duluth and St. Paul locating lines, and their work is pushed as rapidly as possible. The work on the surveys is expected to be completed early in the fall, and the route of the road selected at once and contracts immediately let for the heaviest grading and piling, and the work carried on through the winter.

NASHVILLE.—The contract for the Dunlap Railroad extension extends from the Thomas mines in Sequache Valley to Dunlap, 18 miles, and is a continuation of work already completed from Victoria to Thomas mines, 4 miles, since February 1. There is in progress the construction of 7 miles of heavy mountain work extending the Sparta Branch from Sparta, Tenn., to the Bon Air coal fields at the top of Cumberland mountain. This work commenced February 1, and will be completed in October. All the above work, amounting to about 30 miles, is under contracts awarded to Foster, Creighton & Co., by the Nashville, Chattanooga and St. Louis Railway Company.

TAUNTON, MASS.—The City Government will build an iron bridge over the river at the pumping station.

TOLEDO, O.—Incorporated is the Toledo, Saginaw and Mackinaw Railroad Company: A. W. Wright, of Alma, Mich.; J. M. Ashley, Jr., of Toledo, and others.

BURLINGTON, IOWA.—Incorporated is the Calliope, Burlington and Northern Railroad Company, of Calliope.

DECATUR, ALA.—Incorporated is the Decatur Street Railway Company: W. D. Washburn, A. J. Blether, R. B. Langdon, and others.

DETROIT, MICH.—The Aldermen have authorized the making of a contract with the Detroit Bridge and Iron Works for the Presque Isle Bridge at \$280,000.

BIDS OPENED.

ROCHESTER, N. Y.—The following bids for the fireproof building for the female department of the New York State Industrial School of Rochester, N. Y., were received by D. W. Powers, chairman, and opened by the Board of Managers July 9: C. W. Voshall, Rochester, \$113,089; W. H. Gorshine, Rochester, \$112,000; H. H. Edgerton, Rochester, \$111,487; R. G. Boyd, Rochester, \$110,995; A. Frederick & Sons, Rochester, \$110,853; A. Pappert, Rochester, \$110,500; Ellsworth & Grant, Rochester, \$109,000; Kraft & Siebert, Rochester, \$107,500. The contract was awarded to Kraft & Siebert.

BROOKLYN.—The Supervisors on July 7 opened bids for paving, at the Hall of Records, as follows: P. J. Carlin, furnishing bluestone flagging, \$18,000; granolithic pavement, \$15,600; E. & F. Conklin, \$19,600; H. D. Southard, furnishing bluestone flagging, \$14,749; with granolithic pavement, \$13,197. The bids were referred to the Contracts Committee.

BROOKLYN.—Baker, Smith & Co. have been awarded the contract for steam-heating apparatus in the Court House at \$20,950.

BUFFALO, N. Y.—The Water Commissioners received bids, July 8, for furnishing a 20,000,000-gallon Gaskill pumping-engine, as follows:

With 6 boilers, Holly Manufacturing Company, of Lockport, N. Y., \$99,750.
With 4 boilers, \$94,750.

ST. PAUL.—The City Council has awarded the contract for the up-town bridge to the Keystone Bridge Company, of Chicago, for \$340,324. The bids were:

Edge Moor Iron Company, specification A, \$176,400; B, \$363,400.
M. Lasey, St. Paul, \$135,000.
Keystone Bridge Company, Chicago, \$340,324.
Morse Bridge Company, Youngstown, O., specification A, \$311,000; B, \$324,000.

ST. PAUL.—The Court-House Commission has awarded contract for plastering the new Court House to James Cullen—\$23,549 for lime work and \$26,049 for stucco. The following additional bids were received on carpentering work: Matthias Breen, \$163,357; Johnson Brothers & Loomis, \$179,000, \$143,700, and \$115,647, according to varying grades of work; A. Bassford, \$124,634.40; Bohm Manufacturing Company, \$127,716.65; Corlies, Chapman & Drake, \$134,000; hardware work, F. G. Draper, \$5,000.

BOSTON.—The Court House Commissioners opened proposals for completing the brick, masonry, stone and iron setting of the northerly section of the new court house. The bids were as follows: Sampson, Clark & Co., \$135,270; Whidden, Hill & Co., \$111,748. The contract was awarded to the lowest bidder.

BOSTON.—Bids were received July 8 for building an iron pier at Marine Park, as follows:
Boynton Brothers, Boston, for 26 cast-iron piers, \$42.60 per foot; for 12 spans, \$34,800; for 10 additional pier-piles, \$42.60 per foot; for 5 additional spans, \$14,000.
William G. Coolidge & Co., Chicago, \$38.75, \$39,200, \$38.75, \$26,750, respectively.

Builders' Iron Foundry, Providence, R. I.: \$37.50, \$37,700, \$37.50, \$15,090 (awarded the contract).

BLOCK ISLAND, R. I.—The following bids for cutting a channel from Salt Pond to the Ocean were received by H. S. Millikin for and in behalf of the Town Council July 5: S. V. R. Hendricks, East Hampton, Mass., \$9,740; J. A. Dailey & Son, Providence, R. I., \$9,350. Contract awarded to J. A. Dailey & Son, Providence, R. I., for \$9,350.

NEW YORK CITY.—Bids were opened at the Department of Docks, on July 13, for dredging at Pier 59, North River. The following were the bidders: Union Dredging Company, 20 cents per cubic yard; Charles Du Bois, 23.9 cents per cubic yard.

ST. PAUL, MINN.—The following contracts were reported at the last meeting of the Board of Education for 1887, for school buildings:
Jefferson, \$32,487; Madison, \$14,274; Lincoln, \$10,851; Cleveland, \$21,914; Gorman, \$17,722; Van Buren, \$30,211; St. Anthony Park, \$20,600; Maralester, \$20,900; Mississippi Street, \$32,800; Hamline, \$26,346; Comoville, \$32,570; Jackson School, \$4,519.

The following series of bids with different specifications on the erection of the high school addition were received:

BIDDERS.	1.	2.	3.
J. C. Lillis.....	\$37,300	\$36,100	\$34,030
W. O. Erickson.....	36,000	34,723	34,592
Rundle & Kug.....	36,500	35,500	34,505
F. La Berg.....	36,300	34,075	33,250

The contract was awarded to W. O. Erickson, at \$36,000.

ALBANY, N. Y.—Contracts for dredging were awarded July 11, by State Superintendent Shanahan, as follows: Improvements at Oak Orchard Creek and Tonawanda feeder (\$25,000 appropriated): George M. Taylor, \$22,400; Willard Johnson, \$30,500. Dredging Parada Hook: Charles Brown, Mohawk, 10¢ cents per cubic yard; E. M. Payn, Albany, 15¢; P. W. Myers, Albany, 16¢. Dredging at Bogart light: Charles Brown, 21¢; E. M. Payn, 17¢; P. W. Myers, 17¢. Dredging at Stuyvesant: Charles Brown, 9¢; P. W. Myers, 6¢.

GREEN ISLAND, N. Y.—John McGowan & Co., of this place, are the lowest bidders on sewers, at \$3,000.

ALLEGHENY, PA.—The following bids for boiler, tanks, and sewer castings, were received by the city of Allegheny, July 7 and 11:

For boiler, D. W. C. Carroll & Co., Pittsburg, Pa., \$755 (awarded contract); Thompson, Porter & Co., Allegheny, \$1,225; R. Monroe & Co., Pittsburg, \$845. For two tanks, D. W. C. Carroll & Co., Pittsburg, \$4,567; Thompson, Porter & Co., Allegheny, \$5,900; Ritter & Connelly, Pittsburg, \$4,550 (awarded contract).

Sewer castings, Thomas Carlin's Sons, Allegheny, \$1.75 per hundred pounds (awarded contract).
Union Foundry and Machine Co., Allegheny, \$1.97 per hundred pounds.

STILLWATER, MINN.—Shabel & Currie have been awarded contract for new fire engine-house, \$9,780.

JAMESTOWN, DAK.—At a late meeting of the city council bids for laying water-mains were opened. Eight-inch Kalamain pipe will be used. The bid of Matt Hockers was accepted. He is to lay 2,500 feet of mains with all furnishings for \$4,360. Work must be completed within ninety days of date of contract.

NORWALK, CONN.—Charles N. Wood, engineer, opened bids July 2 for construction of Sub Division 1 of the General Sewerage System, as follows:
Thomas Newman, Brooklyn, N. Y., \$45,200; Luther W. Burt, Hartford, Ct., \$45,019.85; John Bogart & Co., Brooklyn, N. Y., \$44,111.91; A. Bragos & Sons, Middleton, Conn., \$38,374.38; William E. Dean, New York City, \$37,657.83; Francis Leonard, Norwalk, \$34,547.50; Geo. W. Cram, Norwalk, \$33,608.10; James Campbell, Hartford, \$38,901.14; Delos E. Culver, New York, \$37,821.29.

The contract was awarded to Mr. Cram, whose bid in detail was as follows:

For the 66-inch brick sewer, \$12 per running foot; 60-inch brick, \$7.50; 48-inch brick, \$6.50; 42-inch brick, \$6.50; 24-inch brick, \$2.75; 24-inch stoneware pipe, \$2.25 per foot; 18-inch, \$1.35; 15-inch, \$1.15; 12-inch, 80 cents; 20 cents for each 6-inch stoneware or cement house connection in brick sewer; \$1.49 for each 6-inch house connection in either stoneware or cement-pipe sewer; \$5 for each man-hole, complete, with iron head and cover; \$45 for each street basin, with iron cover; 25 cents per foot for catch-basin connections; 40 cents per foot for 10-inch catch-basin connections; \$4 per cubic yard for rock excavations. The quantities were about as follows: Brick sewer, about 300 lineal feet of 66 inches in diameter; about 740 lineal feet of 60 inches in diameter; about 930 lineal feet of 42 inches in diameter; also a Portland cement-pipe sewer, or vitrified pipe-sewer, about 3,350 lineal feet of 12 inches in diameter; about 2,334 lineal feet of 12 inches in diameter; about 725 lineal feet of 18 inches in diameter; about 790 lineal feet of 24 inches in diameter.

FULTON, N. Y.—At the Upper Dam on the east side, Weeks & Redhead have contracted with William Patrick to build a stone flume, with bulkhead, costing some \$20,000.

GOVERNMENT WORK.

The following bids for dredging at Toledo Harbor, Ohio (\$46,000 cub. yds. more or less), were received by Major L. Cooper Osneiman, U. S. A., July 7:

French & Rooney, Toledo, O.; 15c. per cubic yard; all the dredging required.

George Talbot, Buffalo, N. Y.; 16c.; all the dredging required.

George Kellogg, Fulton, N. Y.; 12c.; 423,000 cubic yards.

Stang & Gillmore, Loraine, O.; 21c.; 146,000 cubic yards.

Dodge & Petrie, Chicago, Ill.; 24c.; 141,000 cubic yards.

William & J. W. St. John, Toledo, O.; 16½c.; 141,000 cubic yards.

S. P. & J. A. Smith, Cleveland, O.; all the dredging required.

MONTGOMERY, ALA.—The following bids for a snagboat and machinery were received by Captain R. L. Hoxie, U. S. Engineers, July 6:

M. A. Sweeney & Bro., Jeffersonville, Ind., \$8,400, commencing thirty days after notice of award of contract; completing on or before November 15, 1887; delivered at mouth of Altamaha River, Georgia.

William L. Campbell, Mobile, Ala., \$9,345, commencing thirty days after notice of award of contract; completing on or before December 15, 1887; delivered at mouth of Altamaha River, Georgia.

WASHINGTON, D. C.—Proposals for laying the foundation and furnishing materials for the Library Building were opened July 9, as follows:

For cubic yard, Portland cement—H. L. Cranford, \$5.87; William F. Wheatly, \$5.85; Thomas H. Lyons, \$6.50; J. H. Steeps, \$6.39. American cement—William F. Wheatly, \$3.22, and F. Baldwin, \$4.75. For the whole work, with Portland cement—Jacob H. Dewees, \$107,700; Albert Gleason, \$97,000; E. E. Barnes, \$69,990; H. J. McLaughlin, \$97,500. With American cement, H. J. McLaughlin, \$74,000.

NORFOLK, VA.—The following bid for dredging North River Bar, N. C., were received by Captain F. A. Hinman, Corps of Engineers, U. S. A., July 11: Atlas Dredging Co., Wilmington, Del., 25 cents per cubic yard.

SYNOPSIS of bids for tie-rods for Custom House at Chicago, Ill., opened July 13 by the Supervising Architect of the Treasury Department: Holingsworth & Coughlin, Chicago, Ill., \$22,080; Joseph Downey, Chicago, Ill., \$24,585; William Manson, Chicago, Ill., \$25,735; E. E. Gobel, Chicago, Ill., \$23,550.

MISCELLANEOUS.

LEVEE WORK PROPOSED.—Allotments of work by the Mississippi River Commission, to be approved by the Secretary of War, are as follows:

\$75,000 has been put aside for the levees of the White River basin.

To complete the line of levees that affect the Tensas basin will require approximately about 2,043,333 cubic yards of earthwork, distributed about as follows:

Amos Bayou Ridge to Arkansas City.....	685,733
Duffin levee.....	275,000
Enlargement of levee from Duffin to Boggy Bayou.....	60,000
Boggy Bayou to Panther Forest.....	99,500
Panther Forest crevasse.....	271,600
Linwood to Columbia.....	137,000
Whisky Chute.....	180,000
Brooks Break.....	9,000
Matthews' Bend.....	87,000
Matthews' Bend to Louisiana line.....	238,500

Total.....2,043,333

Fifth Louisiana Levee District (East Carroll):	
Bunche's Bend.....	6,000
All Right.....	35,000
Elton.....	44,000
Lake Providence.....	29,000
Illawara.....	244,000
Madison Parish:	
Ried levee.....	217,000
Diamond Island Bend.....	17,000
Tensas Parish:	
Buck Ridge.....	53,500
Kempe.....	500,000
Concordia Parish:	
Monona to Gross Mear.....	35,000
Lake Concordia.....	150,000
Mono.....	30,000
Deer Park.....	57,000
Roseland.....	58,500

Total.....1,969,000

LOUISVILLE, KY.—A scheme is on foot to establish a comprehensive park system. An organization called the "Association of Louisville" are interested in the project. Municipal officers are also interested.

IRON PIER.—The Riparian Commissioners of New Jersey have given permission to the Gloucester Iron Works to construct in front of their property, just above the Newton Creek, near Gloucester, a large pier. It is to be 600 feet long and 150 feet wide.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; b s d, brown-stone dwelling; apart house, apart-house; ten, tenement; c, each; o, owner; a, architect; b, builder; fr, frame.

AMONG THE ARCHITECTS.

We report the following from the offices of New York architects:

Newport, R. I.—Mr. John O'Brien and Mr. William H. Osgood, of New York City, will each erect a residence at this place, the cost of which will be \$50,000. Messrs. Harding & Dinkleberg are the architects.

St. Augustine, Fla.—Renwick, Aspinwall & Russell are to prepare plans for the rebuilding of the cathedral at this place. A large expenditure will be made.

New York City.—Mr. Andrew Kelly will build a five-story apartment house at 183 and 185 Mott Street. Plans by A. B. Ogden & Son; cost, \$35,000.

Greene, N. Y.—Architects Henry M. Ogden & Son have prepared plans for a new church edifice for the congregation of Zion Protestant Episcopal Church, to be erected here; cost, \$45,000.

NEW YORK CITY.

18 Oliver st., 5-story and basement br ten and stores; cost \$18,000; o, William Morris; a, F Ebel ng.

309 and 311 3d av, br tenement; cost, \$50,000; o, J G Wallace and W J Smith; a, O Wirtz; b, J G Wallace.

84th st, s s, 89 e Av B, 4-story br and at ten; cost, each, \$10,500; o, Louis and John Brandt; a, John Brandt.

9th av, e s, extends from 87th to 88th st, 6-story br ten; cost, corner houses \$30,000 each; others, \$40,000 each; o, C L Guilleaume; a, C P H Gilbert; b, not selected.

7th av, n e cor 118th st, 3 5-story st and br ten; cost, total, \$140,000; o, C H Bliss, Rutland; a, E L Angell.

6th av, n e cor 134th st, 5-story br ten; cost, \$21,000; o, James Parris; a, M V B Ferdon; b, James Norris.

N e cor Av A and 56th st, fr structure; cost, \$35,000; o, George David Curtis; a, David W King.

S e cor 9th av and 76th st, br flat and store; cost, \$25,000; o, Leonard Buckman; a, George M Walgrove.

20 W 13th, br stable; cost, \$15,000; o, Laura F Hearn; a, John B Smith & Son.

530 W 25th, br factory; cost, \$25,000; o, John Graham; a, George B Pelham.

121-125 E 23d, br works; cost, \$12,000; o, Harriet W Smith; a, Edward D Webb.

N e cor 154th st and Elton av, br ten and store; cost, \$10,000; o, Henry Gerken; a, M J Garvin.

N s 145th st, bet 8th and New av, q br ten and store; cost, \$174,500, all; o, Francis J Schnugg; a, Herter Bros.

N e cor 10th av and 80th st, br ten and store; cost, \$28,000; o, John P Thornton; a, F T Camp.

E s 10th av, 27 n 80th st, 3 br ten and store; cost \$54,000, all; o and a, as above.

N s 80th st, 80 e 10th av, flat, cost, \$18,000; o and a, as above.

ALTERATIONS—NEW YORK.

124th st, s s, 250 e 1st av, rear of lot, cost \$15,000; o, Abraham Steers; a, Fred Kehoe; b, C R Kehoe.

200 and 202 W 38th st, to be connected; cost, \$10,000; o, Eliza W White, Litchfield, Conn; a, W W Smith; b, J J Tucker; c, J C Hoes's Sons.

225 William st, br factory; cost, \$12,000; o, Mrs. E Heppenheimer; a, Weber & Drosser.

46 W 28th st, br flat and store; cost, \$15,000; o, E J Donnell; a, Keister Wallis.

BROOKLYN.

9th st, s s, 195 w 5th av, 8 4-story b s stores and ten; cost, each, \$12,000; o, S B Oulton; a, W H Wirth; b, not selected.

Kosciusko st, s s, 100 e Lewis av, 13 2-story and basement br dwell; cost, \$4,000; o, a and b, Joel E. Skidmore.

Evergreen av, w s 75 n De Kalb av, 2-story fr ten; cost, \$5,300; o, Ph. Henry Schoenig; a, H Schoeffler; b, Ioeser & Schneider, and J Dreher.

De Kalb av, n w cor Evergreen av, 4-story fr store and tenement, 25x60, tin roof; cost, \$8,800; o, &c., same as last.

E s Jackson av, 90 feet n of Prospect av, 3 fr dwells; cost, \$9,750, all; o, Ralph Kirkman; a, Wm H Wirth.

S s Montague st, 104 ft e of Montague terrace, 1 br flat; cost, \$125,000; o, C D Burwell; a, Montrose W Morris.

MISCELLANEOUS.

BELLEFONTAINE, O.—M. E. church here. Address Alfred Butler.

SPRINGFIELD, ILL.—Two 3-story bldgs; o, Milton Hay; b, J T Rhodes.

MEMPHIS, TENN.—It is proposed to build a \$300,000 court-house.

POTSDAM, N. Y.—2 stores, sand stone fronts; cost, \$10,000; o, James A Cox; a, J P Johnston, Ogdensburg, N. Y.

KANSAS CITY, MO.—Wyandotte, near 9th, 7-story bldg and office; cost, \$150,000; o, D T Beal & C L Dobson; a, Van Brunt and Howe.

N e cor 16th and Bell, 3-story store; cost, \$15,000; o, W P Herring.

12th st and Bellfontaine av, 2-story fr dwell; cost \$19,200; o, Wilson & Graham.

Drepp st, 2-story fr dwell; cost, \$7,500; o, M H Cohen.

S e cor 12th and Charlotte, engine house; cost, \$45,000; o, Metropolitan Street R Co.

14th and Holmes, parsonage; cost, \$8,000; o, Lutheran Church.

S w cor Cherry and 14th, church, cost, \$34,000; o, Lutheran Church.

Ord st near Elma, 4 br dwells; cost, \$10,000; o, Flovd & Emery.

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THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

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VOLUME 16. }
NUMBER 8. } PUBLISHED EVERY SATURDAY.

NEW YORK, JULY 23, 1887.

LONDON, AUGUST 5, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

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SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 20, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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LEAVES OF ABSENCE FOR MUNICIPAL ENGINEERS.

PROBABLY no man now living has had so large an experience with the varied problems of municipal engineering as the eminent engineer who for many years has been at the head of the Engineering Department of the Local Government Board of Great Britain. Sir Robert Rawlinson's letter, therefore, which will be found elsewhere in this issue, is to be commended to local authorities as a plea for leaves of absence for engineers from a man whose experience attaches weight to his utterances.

Aside from the question of considerate treatment of employees, which so much tends to secure zealous and loyal services, so important in professional positions, the so-called "practical" man, with whom such a consideration frequently does not count for much, should be reminded of the fact that municipal engineers who have had an opportunity to observe and note the experience of others are of direct and positive pecuniary value to the community that employs them. Published reports are not usually filled with a record of mistakes or failures and their causes; these can best be learned through personal inquiry and investigation by trained men. It pays, therefore, to ascertain by the experience of others what to avoid, and this fact should be obvious to even the most obtuse and narrow-minded member of any municipal board.

THE HEATED TERM.

THOSE readers of THE SANITARY ENGINEER AND CONSTRUCTION RECORD who have spent the last two weeks in one of our large cities have some idea of the languor and exhaustion, mental and physical, which a few days of continuous high temperature can produce in those subjected to it. The vibrations of force which come to us from the sun, and which are the source not only of almost all the mechanical power we command in the shape of wind, water, and coal, but also of the force manifested in all vegetable and animal life, become at times too strong and continuous for the delicate machinery which exists in the human body to regulate their effects upon it. The miles of fine tubes in the human skin, with their millions of orifices, and corresponding millions of fine nerve fibres which regulate their action and control the blood-currents which surround them in ceaseless flow, drain the fluids of the body by the evaporation which they produce until one almost feels his blood thickening under the process. And in the great city no small part of the blazing heat of the day is stored up in the masses of brick, and stone, and iron of the houses and streets, which become like a gigantic oven, and slowly radiate it out at night. With the first continuous hot wave of the season comes the great mortality of the year among the infants of the city, and especially among those of the tenement-house population. Upon the results of that week or ten days depends largely whether the death-rate of the city for the year shall be high or low. Then is the time when the weak go to the wall, "when the little fingers that just barely have a hold on the slippery edge of life relax their too feeble grasp," and the ill-fed, badly nourished, overheated children die gasping for pure cool air.

Something is done for their help. The corps of inspectors of the Health Department, lecturing, helping when

but too often too late to do much good. We have the water excursions, and a thousand other channels by which private charity comes to the rescue; but the melancholy confession must be made, that with all the means for help which exist, and with all our increase of knowledge as to the causes of the heavy loss of life in our cities during the heated term, the loss itself still seems largely inevitable.

Those who can escape from the city with their children need no journalistic advice. If the infant falls ill from the heat they will get their orders, short and clear, from the first physician they call in; but those who cannot go, and who are packed in small rooms, supplied with air from foul courts and passageways—what is to be done for them? It is much easier to ask the question than to answer it; in fact, for the lowest class of the tenement-house population we do not believe it can be answered. But it is certain that little can be done by mere temporary expedients or by the use of drugs. If the Tenement-House Act is enforced throughout the year it will have a great effect on the mortality during the heated term, and with this, with the provision of abundant and pure water-supply, the preservation of cleanliness in the streets, and the prevention of the sale of unwholesome food, the powers of the municipality are well nigh exhausted. The time of greatest trial is, fortunately, soon over, and those who survive soon recover. This process of natural selection, resulting in the survival of the strongest, is a sharp remedy, but perhaps it is the only one which will keep the race in existence. Meantime, whatever may be thought of the expediency of official interference, it is certain that private charity finds here one of its best fields for exercise. To give a poor child a chance to have cool fresh air for a week is not much to ask, and there are plenty of ways in which ten dollars can be well invested in this direction in any city, though we are speaking here more especially of New York.

THE DRAINAGE QUESTION IN CHICAGO.

AFTER all the trouble and expense attending the recent examination into the question of the sewage disposal of this great city, there is now a growing feeling that it is best to continue the present methods and to preserve the purity of the water-supply by extending the intake further into the lake.

This looks very much like a begging of the whole question and a simple deferring of the inevitable to a later date.

The idea of taking drinking-water from the same tank into which slops are poured is justly revolting, and this is doing the same thing on a larger scale. Doubtless the danger of contamination is somewhat remote, but it will be an increasing danger as years roll on.

But what are we to say of the willingness thus shown to make the shores of the lake a nuisance? All experience points to this as a certain result. There may be no immediate danger to life and health, but there will certainly be offensive sights and offensive smells. The time is surely coming when every community, large and small, will be required to so dispose of all refuse, of whatever sort, as to cause no offense, danger, no contamination of streams or of shores of masses of water, be the expense

what it may. We shall regret to see the enterprising city of Chicago doing anything which is not fully justified by the best practical science of the age.

NATURAL FILTRATION.

THE paper of G.W. Pearsons, M. Am.Soc. C.E., on "Natural Filtration," which we elsewhere print, treats of a subject which has several times been discussed in our columns. When the author of the paper narrates facts which have come under his own observation, he is interesting, but where he theorizes it is difficult to agree with him; chiefly, we imagine, because his theories are not explained with sufficient clearness. The discussion of the passage of water through the Long Island sands is altogether unintelligible. The statement that a mass of water 200 feet deep is constantly moving toward the sea in the sands of Long Island at an average rate of nine feet a day, the surface water moving at the rate of twenty-

OUR BRITISH CORRESPONDENCE.

Architectural Education—Danger in Connection with a Gas-Supply for Train-Lighting—Generosity on the part of the Mumbles Water-Works Owners.

LONDON, July 6, 1887.

A DISCUSSION on architectural education has been going on in London under the auspices of the Institution of British Architects, almost *pari passu* with that going on in the columns of THE SANITARY ENGINEER and CONSTRUCTION RECORD. The practical outcome of this discussion is the establishment of an atelier for architectural students in London. This is set up under the direction of Mr. F. T. Baggallay, Royal Academy Gold Medallist, and Mr. Walter Millard, Royal Academy Traveling Student and Pugin Student. The special objection to this atelier would seem to be that the directors only make certain visits during the course of the day, the atelier being totally distinct from the business premises of the directors. So long as the said directors are not in possession of a

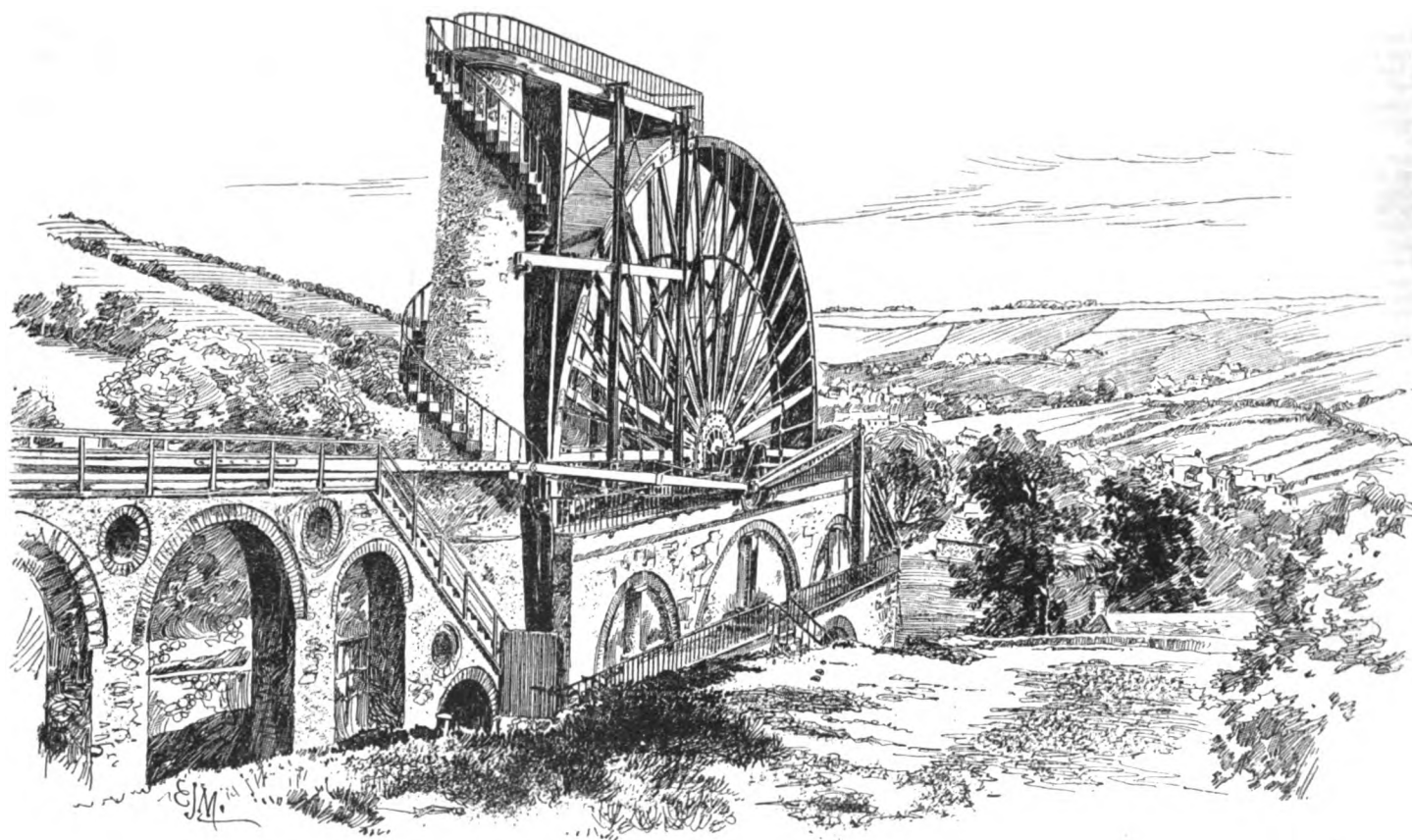
In connection with the long drought we have been experiencing here, reports come from all parts of the country of shortness of water-supply, and in some places of water famine. The action of Sir John Jenkins and his fellow-owners of the Mumbles Water Works, whose mains reached to within three miles of Swansea, is worthy of record and imitation. Swansea has been in great difficulties from the drought, and Sir John Jenkins wrote to the town clerk to say that this was not the time to seek to make money out of Swansea's difficulties, and offering to supply the town with the Mumbles Water Works' surplus water, free of charge, during the period of the drought.

SAFETY-VALVE.

OUR SPECIAL ILLUSTRATION.

HALL IN MRS. BENT'S HOUSE, LONGWOOD, MASS.—E. A. P. NEWCOMB, ARCHITECT.

OUR special illustration this week shows the hall in Mrs. Bent's house at Longwood, Mass. The architect is Mr. E. A. P. Newcomb, of Boston, Mass.



THE LAXEY WATER-WHEEL, ISLE OF MAN, ENGLAND.

four feet a day on a slope of five to seven feet in a mile, does not accord with either theory or experiment.

The description given of the method adopted by the author for collecting the ground-water for the supply of Rockaway Beach on Long Island is interesting, and we are pleased to note, what to be sure was only to be expected from a man so practically scientific as the author, that the existence of magical virtues in "driven wells" is not at all conceded by him.

The valuable memoranda given as to the quality of the ground-water in different places show the necessity of calling on both an engineer unbiased by a predilection for any "system," and a chemist, before deciding to use ground-water anywhere for a supply for domestic purposes.

THE American Institute of Mining Engineers met at Salt Lake City July 6. Mr. Thomas Egleston delivered the president's address.

large amount of business, they can, of course, devote proper attention to the matter; but in the event of their receiving a fair share of business, such as one would presume their abilities would command, it is not likely that they will be able to devote a sufficiency of attention to the "school." Further, it is questionable whether the pupils will find sufficient sustained interest to enable them to persist with their work on the presentation of any special difficulties in the absence of their guide, philosopher, and friend, whose duty it would be to make the matter clear to them.

An accident reported from the Berlin and Potsdam Railway illustrates the danger in connection with the gas-supply for train lighting, which should be taken as a warning. The reservoir for gas consisted of a sheet-iron drum. A passing locomotive collided with the drum, bursting same, and causing explosion and fire. There was, fortunately, no damage to life or limb resulting, but it points a moral that such reservoirs should, so far as possible, be placed out of the way of the possibility of such accidents.

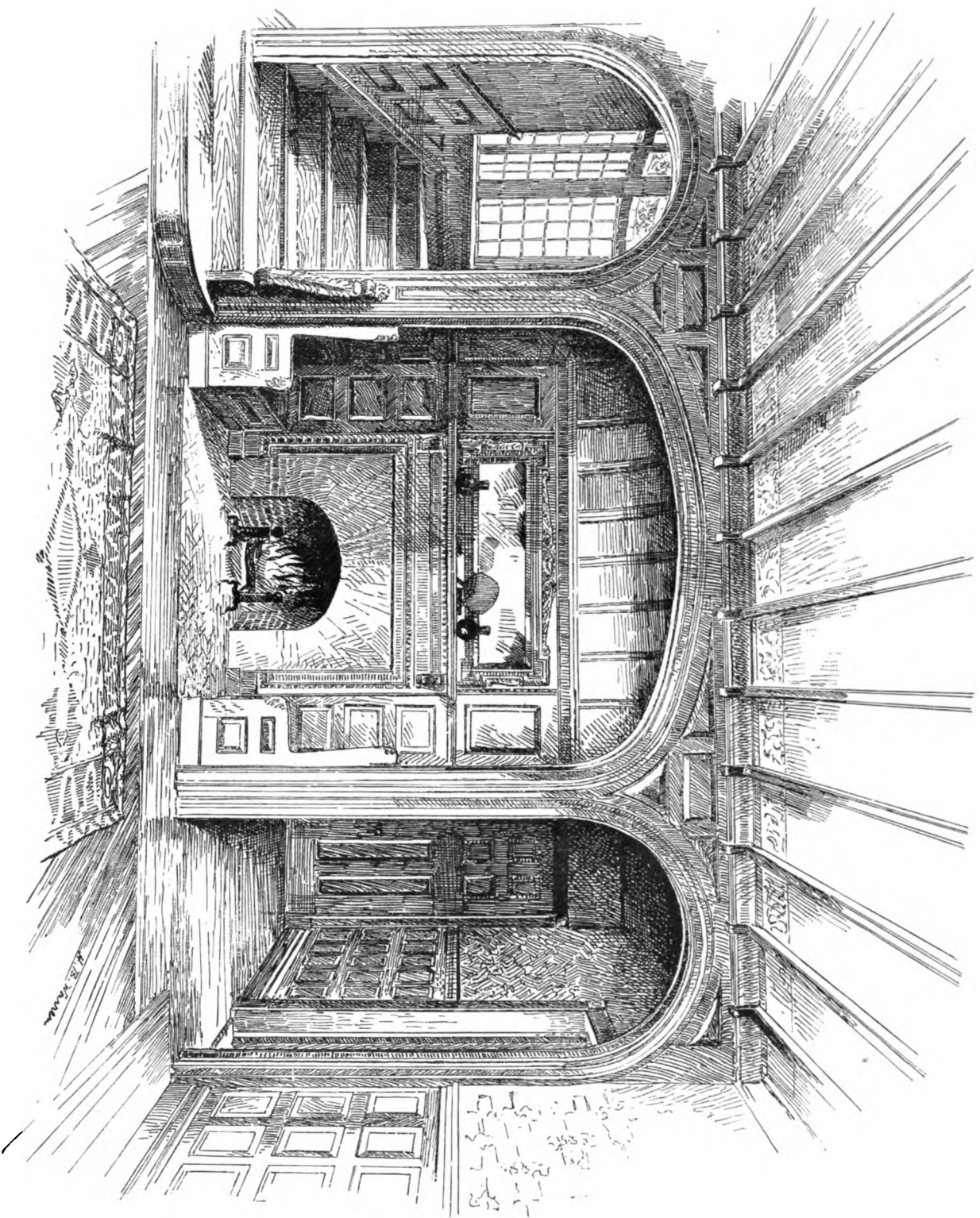
OUR VIGNETTE ILLUSTRATION.

THE LAXEY WATER-WHEEL, ISLE OF MAN, ENGLAND.

THE Laxey wheel, illustrated in this issue, is said to be the largest water-wheel in the world. It is used to pump water from the Laxey mines on the Isle of Man, the water being raised two hundred fathoms. The dimensions of the wheel are: diameter, 72 feet 6 inches; breadth, 6 feet. It makes two revolutions per minute. It is an overshot wheel, and said to be so truly set that a deflection of one-eighth of an inch cannot be detected. The water to operate it is brought from the mountains and ascends through the circular pillar.

PHILADELPHIA ELECTRICAL SOCIETY.

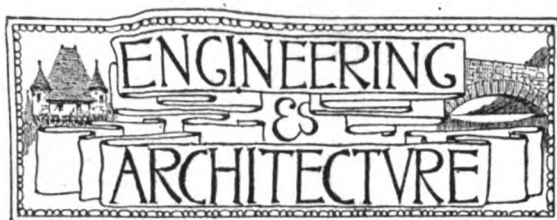
THIS society, which was organized recently, has elected officers as follows: President, M. D. Law; Vice-Presidents, John Sager, H. B. Cutter, and C. M. Knapp; Recording Secretary, D. R. Gibbs; Financial Secretary, W. O. Snyder; Treasurer, A. F. Reed. Board of Managers (for one year), F. W. Griffin, W. McDevitt, A. H. Manwarren, A. Ford, D. A. Curl (for six months), W. S. Leigh, Mr. Roberts, and R. J. Park.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HALL IN MRS. BENT'S HOUSE, LONGWOOD, MASS.

E. A. P. NEWCOMB, ARCHITECT.



TUBULAR SUBWAY UNDER NORTHUMBERLAND STRAITS FROM NEW BRUNSWICK TO PRINCE EDWARD ISLAND.

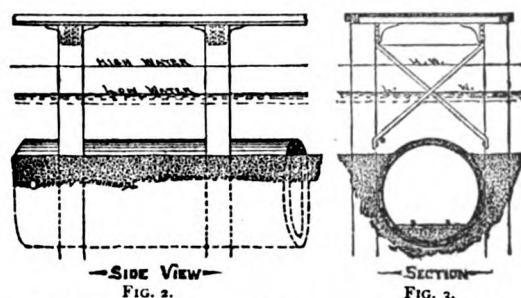
IN 1872, when Prince Edward Island went into the confederation of provinces which form the Dominion of Canada, the Government guaranteed among other things to keep open winter communication with the mainland, and, in 1873, the winter steamer "Northern Light," built specially for ice duty, was put on to do this. She failed to do this properly, and is only capable of crossing with the mails and a very limited number of passengers, and small freight packages may also be crossed at favorable times.

Immense ice-floes from the Gulf of St. Lawrence continually pass back and forth through the Straits with every tide, and, under certain prevailing winds, pile up in a manner impossible to pass through. Several times the "Northern Light" has been carried away by the ice, and once or twice carried upon the rocks and supposed lost for several weeks until released by a breaking up of the floe. The

States by Hayden H. Hall, President of the Submarine Tunnel and Tube Company of New York, and exhibited lately in model at the Provincial Exhibition, in Charlotte-town.

J. G. Jonah, C. E., for the Dominion Government, made a survey of the Straits in September over the proposed route. The bottom was found free from rocks and composed of brick-clay, sand, and gravel.

Figure 1 is a copy from surveys of Mr. Jonah, giving soundings and borings, which vary somewhat, though not



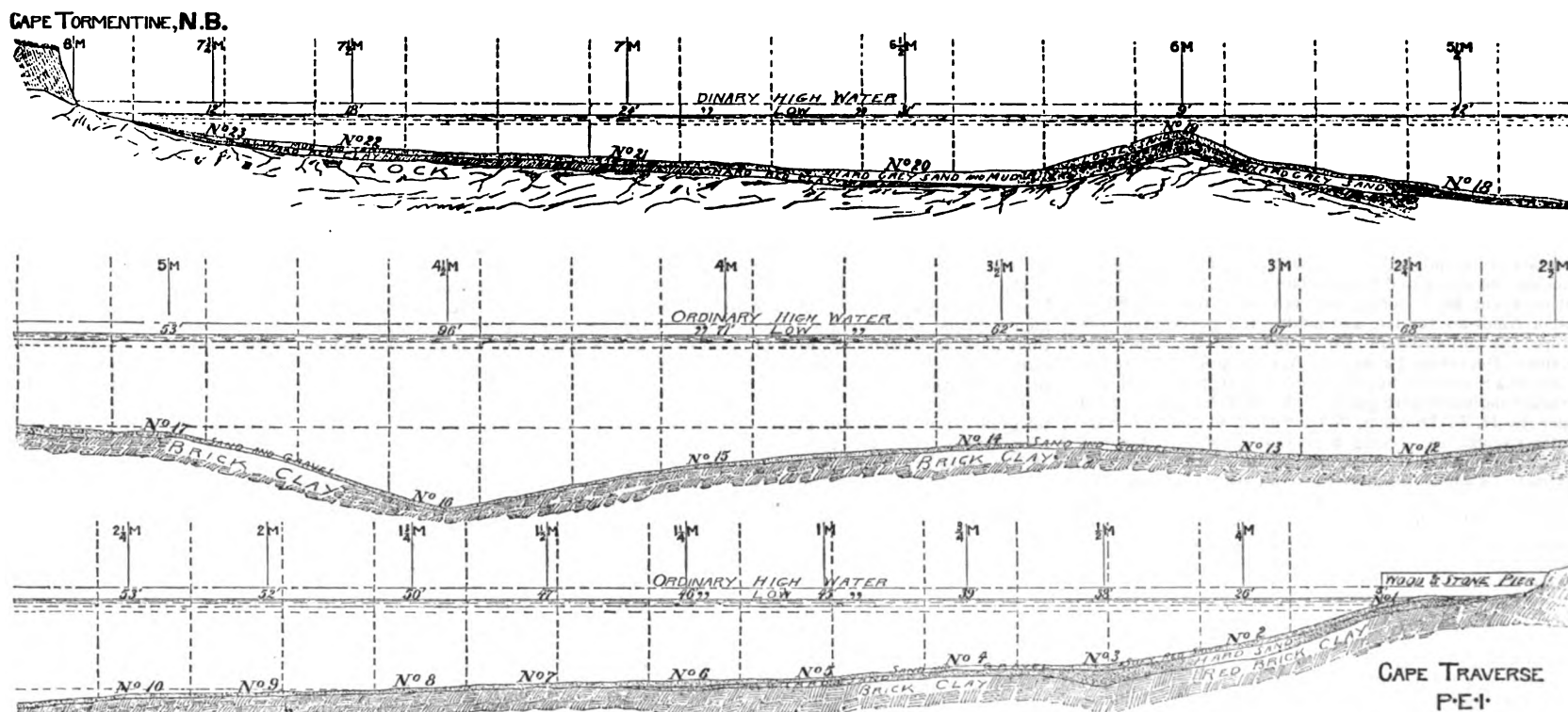
greatly, from the former official surveys. In the profile the vertical scale is twenty times what the horizontal scale is. The soundings are marked in feet from low water, and the distances in miles from Cape Traverse. The borings of the bottom were made at the distances marked 1 to 23, inclusive, and show sand and gravel overlying brick-clay to near the shallow water between Nos. 18 and 19. Then hard gray sand and loose gravel is found. It is at this point that the tube is to come out of the water. The great-

THE CINCINNATI CITY HALL COMPETITION.

JULY 16, at noon, was the time set for the submitting of the plans for the new City Hall, to cost \$600,000. When the time had arrived, it was found that fourteen architects were competing for the prize. Through the kindness of Mr. Robert Mitchell, the large room at the rear on the first floor of the Mitchell Office Building is used for the exhibition of the drawings. The competing architects are: H. E. Siter, S. E. Des Jardins, Schuerman & Kennedy, James W. McLaughlin, and Samuel Hannaford & Sons, of Cincinnati; J. F. Denson, Washington, D. C.; W. M. Walter, Chicago; Johnson & Scobey, Chicago; E. L. Rice, Wilmington, Del.; James Balfour, Hamilton, Ont.; John Schaarschmidt, and F. E. Sulzer, New York; J. W. Yost, Columbus, and two nameless plans. Secretary Allison says that they will receive instructions by mail, no doubt, as to who the nameless parties are.

The bulletin of the Central Society of Architects of Paris contains a report by M. Julien Bayard upon two books by Mr. Glenn Brown, of Washington, the first of which, "On Sanitary Foundations," was first published in THE SANITARY ENGINEER and CONSTRUCTION RECORD, and the second, "On Water-Closets," was first published in the *American Architect*.

M. Bayard reports that both of these works merit translation and publication in one of the French technical architectural journals.



SECTION SHOWING BORINGS ON LINE OF PROPOSED SUB-WAY ACROSS NORTHUMBERLAND STRAITS.

amount of subsidy granted annually by the Dominion Government to this province for ice-boat, summer steamers, and loss on the island railway is about \$200,000.

The object of the submarine tubular railway is therefore to secure to Prince Edward Island what was promised at the first, but without any definite idea as to how it was to be carried out, until, in 1873, Hon. George W. Howlan, a member of the Dominion Senate, and since 1862 a United States consular agent, conceived the plan of an iron tubular subway for a railway-track so that goods could be shipped through at all seasons without change of bulk, and the shortening of time to hours, not days, and increasing the trade with the United States, as there can be no moving of freight during the winter months.

The shortest distance from Prince Edward Island (Carlton Head, Cape Traverse) to the mainland, Cape Tormentine, in New Brunswick, is eight miles. It is proposed to run out on piles two miles from the New Brunswick shore, or to the 6-mile mark, Fig. 1, and then follow the contour of the bed of the Straits, sinking the tunnel in the clay bottom.

The tunnel will be sixteen feet in diameter, built in segments of five segments to the circle, in 10-foot lengths, composed of cast-iron, and lined inside with two feet eight inches of concrete in the bottom and one foot around the circle. It will be laid by a plan recently patented in the United

States. The work is thought a simple and practicable one, and will take about three years to build from the time it is started, and will cost about \$5,000,000. A company has been lately organized for this purpose.

Figures 2 and 3 show the side view and cross section of the sea end.

The work is thought a simple and practicable one, and will take about three years to build from the time it is started, and will cost about \$5,000,000. A company has been lately organized for this purpose.

THE DÉBRIS QUESTION IN AUSTRALIA.

THIS question has been taken up by the Colony of Victoria, and a commission appointed for the purpose has reported to the Minister for Mines, recommending that the inspectors of mines for the colony should be appointed *débris* inspectors, and that every mining company should be required to build impounding dams with such provisions for flood-waters that they shall not sweep any of the tailings or *débris* from hydraulic mining over the dams.

No permission in future should be given for hydraulic mining until proof has been given that sufficient area can be obtained for such impounding reservoirs; the sufficiency of such areas and the plans for dams to be decided on by the *débris* inspectors, and they are to hear and make suggestions for remedying any complaints by landowners who think themselves injured by mining refuse. The Government to maintain the dams after the abandonment of the mine.

The provisions of this report are to be incorporated in a bill which will be submitted to the Legislature.

A NOVEL WAY OF DRAINING A CELLAR.

ST. PETER'S Episcopal Church at North Greenfield is probably the only religious edifice in Wisconsin which depends upon champagne bottles for its drainage. When the church was built funds were very scarce, and many small economies were practiced. The congregation on first occupying their place of worship found that it was uncomfortably damp. The fact was mentioned to the late George Stevens, who said: "I'll tell you how to remedy that. Go into my cellar and you will find enough champagne bottles to build a drain with. They are often used for that purpose in England, and when once laid will last forever, if not allowed to choke up." The bottles were secured, the bottoms deftly knocked off, and the necks abbreviated in length. Then, by placing the neck of one bottle in the bottom of another, and so on, a drain was constructed which has kept the little church "extra dry" ever since.—*Milwaukee Sentinel*.

MR. ANDREW GILES, of San Antonio, Tex., has sued El Paso County for moneys due him for services as architect of the county court-house and jail built two years ago. The county offered some time since to pay him in court-house bonds, which he declined to accept in place of money. The county claims that he modified his plans in collusion with the contractor, after contract had been let, so as to increase the contractor's profits.

THE AMERICAN WATER-WORKS ASSOCIATION IN ANNUAL SESSION.

(By our Special Correspondent.)

MINNEAPOLIS, MINN., July 16, 1887.—Those who have been in attendance upon the seventh annual session of the American Water-Works Association, just held in this city, have not only found the time pleasantly spent, but most profitably. The attendance has been good throughout, and the men who have contributed so signally to the success of the occasion by presence, by paper, and by debate, have been men of national note in this all important department of municipal, sanitary, and economic life. Earnest, thoughtful, practical men are these, wielding immense power. It was 11 o'clock Wednesday morning last when President B. F. Jones, long of beard, pleasant of countenance, affable of speech, called the association to order and read a pungent opening address, in which he dwelt, in a general way, upon the mighty problem of pure water for the future. He cleverly criticised a Denver paper for its attack upon the article by City Engineer Keating, of Nova Scotia, presented at the last session of the association on "Fungus or Mossy Growth in Clear Water." President Jones introduced to the association Mr. Y. Nakajinni, a graduate of the Imperial University of Tokio, Japan, and now visiting America and Europe to practically perfect himself in the department of hydraulic engineering. He was unanimously chosen an honorary member, and, in his response to the courtesy, made merriment by his rather ineffectual but interesting English. Alderman Mills, in the absence of Mayor Ames, formally welcomed the guests, and Supervisor Matthew Walsh, of the City Water-Works Department, added words of welcome and the customary panegyric on the city of Minneapolis. President Jones responded on behalf of the association in an address which was pleasing as well as pointed. In his remarks he said:

"Among our number you can find some amply able to select a source of water-supply; some to tell you the proper kind of machinery and where to get it; some who know all about grate-bars, smoke-stacks, and perfect combustion, while others are supplied with chestnut gongs for the advocate of smoke consumption. Others are experts in the matter of dealing with the public as to rules and regulations in water-waste, motors, etc., etc., while there are still others, doubtless, who could discuss more or less intelligently upon fungi, algæ, bacteria, microbes, organic matter, nitrates and albuminoids and their special adaptability to the human stomach."

Secretary Decker—than whom it were hard to find a secretary more obliging—then read his brief annual report, showing 180 active and 51 associate members. The association spent \$675 during the year and received \$905. Mayor Ames arrived late and made a few general remarks before the adjournment for dinner. In the afternoon Secretary Decker read a paper by A. C. Sekell, on "Ground Water as a Source of Supply," favoring such water if the natural conditions were good. The Secretary also read a paper by H. F. Dunham, of Cleveland, O., on "Private Water Companies," taking a general ground in favor of private corporations where ordinances were properly guarded. Some slight discussion followed in which Mr. Pearsons maintained that ordinances were often granted containing loopholes of advantage to the contractor, and urging that the source of supply should be studied very closely.

President Jones said that it was a more important subject to the people than to the man who got the franchise first, for he generally sold out to some one else. The paper on "Revolution Counters: Is their Record Reliable in Computing Pumpage?" was not given, but a general discussion on the subject was engaged in.

Mr. Gardner, of New Orleans, one of the most animated members of the association, wanted definite information as to the reliability of the counters, and made note of the fact that his engineer had fooled him as to results by tampering with the counters.

Mr. Briggs, of Indiana, who has a pat and oftentimes telling remark upon almost any subject, said that he couldn't imagine why the engineer should do such a thing any more than he would pump water and steal in order to make a better showing for his pumps.

President Jones put his views in a line: "Keep your pumps tight and the counter will be all right."

Mr. J. B. Bassett, of Minneapolis, (not a member of the association), held that if the plunger pump was used the counter would record the pumpage with great accuracy, but it would not if the double-action piston pump was used. Another paper was read by the secretary—"Recording Gauges," by Charles A. Hague—and Mr. Denman in considering it made a plea for more wages for engineers. The following new members were admitted during the day:

R. M. Jones, R. C. Pearsons, Wyandotte, Kan.; H. C. Parrott, Lockport, N. Y.; W. A. Bixby, Galena, Ill.; W. H. Getchell, Faribault, Minn.; C. S. Drummond, Winnipeg; H. S. Van Cleve, Andrew Bergstrom, and F. F. Moody, Minneapolis.

Invitations were extended to the St. Paul and Minneapolis engineer clubs to join in the deliberations of the association.

The day proved to be a busy one indeed and an interesting evening session completed it in fine style. The question-box was the centre of attraction, and so important were the queries that but two were considered in the whole evening. The first was as follows:

"On what basis should water-works property, owned by private corporations, be assessed as compared with the as-

essment of other property, and what should be the assessment of water-mains and hydrants?"

Mr. Beach, of Minneapolis, referred to the taxation of the water-works at Faribault, Minn., which were not taxed on what they were worth standing alone but on what they were worth in connection with a franchise to maintain water-works. In Minneapolis, he understood, the gas-works were assessed by an agreement at the rate of \$10 per ton for their pipe—about what it would bring for old iron. He held that pipe ought not to be taxed in connection with a franchise.

Mr. Donahue, of Davenport, thought the matter should be fixed in the franchises.

Colonel Henion, of Minneapolis, thought it was a question for the courts. The water powers, so far as he could see, could not influence the decision of the courts.

President Jones couldn't see why a city should maintain water-works any more than it should a brewery or any other manufactory.

George H. Chandler, of Kalamazoo, Mich., was a valiant and single-handed combatant for the municipal water-supply system. Others gave fragmentary expression to various ideas. The second question that came out of the box was the one which is a good deal like "Which was the greater patriot, Lincoln or Washington?" for it was: "Are water-works more economically managed by public or private corporations?"

Mr. Gardner maintained that over one-half of the United States was owned by corporations and thought they should own the water-works systems. Mr. Briggs thought it better for the citizens to have the city own the works. President Jones still stuck to his theory that the city should not own water any more than beer. Mr. Gray, of Wisconsin, sounded the political alarm—was afraid politics would creep in where there was city ownership. Mr. Chandler, of Kalamazoo, Mich., believed that a city could build as cheaply as a corporation, and scouted the idea that employees should be changed every time parties did. Mr. Pearsons, of Kansas, favored private ownership. The hour was late and the convention adjourned for the day.

THE SECOND DAY.

It was a little after 10 o'clock when the members came into the Ladies' Ordinary of the West Hotel, where the sessions are being held. The prompt and business-like methods of the association were exemplified again, though the chairman does not attempt to hold a tight parliamentary rein when matters of vital importance are being considered, even a little irregularly. It has been one of the helpful features of this convention that when there have been injected into the programme at unexpected moments special questions for consideration by the association, they have been questions of live, vital, practical interest, not only to the water-works managers, but to the people at large.

The Secretary announced that about fifty letters and telegrams from prominent people had been received, and they were accepted and passed without reading. Mr. G. W. Pearsons read the first paper of the hour, and which proved a most interesting one, on "Natural Filtration."

After the paper, by special request, Mr. Beach reviewed the description of the Denver water-works, given at the last annual session, for the benefit of those who were not present at that meeting in Denver. Mr. Beach referred to the water in the Missouri River, near Pierre, Dak., showing that it rose and fell in exact unison with the water in the water-works well—150 feet from the bank, and in no way connected with the river. The local engineer was present also, and gave, in a plain, blunt, but interesting style, a description of the works. He showed that though the well bottom was twenty feet below the bottom of the river, yet the water rose and fell the same as that in the river, and had, moreover, almost the same chemical properties as the water in the river. The water came forth from its percolation pure and clear.

Mr. Gardner, of New Orleans, said that it was almost impossible for water to percolate through the river bottoms.

Mr. Beach, in some entertaining general remarks, referred to a well dug in a Dakota town, near the Missouri, where the water, when struck, was positively filthy, and had such an intolerable stench that the men could not proceed with the work.

Mr. Briggs, of Indiana, referred to the water in his town (Terre Haute), and, after detailing experiences, said that no water would filter from a river into a well.

Mr. Hodgkins put a practical question to any body who would answer it, wanting to know, first, whether the water in the well adjacent to a river came from the stream or ran into the stream; and, second, if it was a fact that when you dug a well near the river you got river water, what on earth was the good of digging the well when the river was there.

Mr. Briggs said the reason they didn't take it out of the river in many cases was because it was so infernally muddy.

City Engineer Rinker, of Minneapolis, wanted to know if the water in the rivers of Minnesota was not purer and better than when it was percolated. He referred to the fungus growth running in some cases from 100 to 200 feet out into the lakes in this State, and maintained that it was as well to pipe to the rivers as to carry it through a filter to a well.

Mr. Espy showed how water might be filtered by percolation and yet not be eliminated of any mineral substances. He couldn't see the good of the filtering.

Mr. Denham described somewhat in detail the gallery system, if such it may be called, at Des Moines, Ia., and showed how they had obtained pure water after much difficulty. They were pumping from 1,000 feet away as high as 5,000,000 gallons a day, yet it hadn't begun to exhaust their supply. He recommended very highly the ninth annual report of the Massachusetts Board of Health, prepared by Geo. H. Nichols. Mr. Gardner read a paper by J. D. Cook, of Toledo, O., on "Filtration or Subsidence," and then one by himself on "Classification and Purification." Mr. Denman read a long paper by W. C. Conant, of New York City, bearing on the advisability of copying after nature. The association then adjourned for the forenoon.

The afternoon was warm and sultry and the delegates dropped in slowly. The Secretary read a paper by S. McElroy on "Fungus or Mossy Growths," or rather started to read it, and after wading through ten pages, the association decided that he might print the fifteen unread with the first ten and they would listen to something else. The paper on "Elevator Indicators," by J. N. Tubbs, was not presented. "Reservoirs, Open or Closed," was the subject of the paper by G. E. Beach, of Minneapolis, and it proved one of the most interesting ones the convention had yet listened to. At its conclusion Mr. Beach read an exhaustive and very long paper on the legal aspect of water, taking the general ground that water was a commodity, and water rates were not taxes, though property could be sold to satisfy the demands of these rates the same as for taxes. He wanted them to understand that they could not stop water to compel a man to pay a debt which was owing for something else than water, nor could a water company shut off a subsequent tenant because a preceding tenant had failed to pay. He held that a tenant could not keep a hydrant in his yard and say to the water-works company he was not using it; he must cut it off entirely or pay rates. At 4:30 o'clock the carriages which were in waiting conveyed the members of the association to Minnehaha Falls, and they passed a pleasant hour on the trip.

THE THIRD DAY.

In the morning the members of the association were driven about the city in carriages and visited various points of interest. The last regular session was then held and was largely devoted to routine business of only immediate interest. One paper, however, was read by Mr. Denman, of Des Moines, prepared by himself, which was in a certain sense supplemental to the long treatise given by him the day previous. He held among other things: That percolating waters found in wells, or oozing through the soil, or standing upon the surface belong as absolutely to the owner as the land itself; that water-courses are common in the sense that property rights do not actually exist in them, and that after a person has appropriated water taken from a common source it cannot be taken from him without violation of law. Water in pipes, the speaker held, was personal property. A water-works plant no more makes the water distributed really than does mill machinery make flour really.

It was decided to print this paper of Mr. Denman and his treatise on the legal points in pamphlet form. A committee was appointed to prepare suitable eulogies on deceased members. The regular papers all being exhausted it was decided in order to select the place for the next annual meeting. Various members named the good points of Detroit, Baltimore, Washington, Pittsburg, and Cleveland. The latter place was chosen, and April 13, 1888, selected as the date. Resolutions were adopted thanking Colonel Henion, of Minneapolis, and his associates on the Committee of Arrangements and expressing the customary stereotyped but sincere thanks. The nominees of the committee appointed to name officers for the ensuing year were unanimously chosen and are as follows:

President, Col. J. T. Fanning, of Minneapolis; Vice-Presidents, J. M. Diven, Elmira, N. Y.; N. J. Milner, Birmingham, Ala.; Col. J. W. Henion, Minneapolis; J. P. Donahue, Davenport, Iowa; H. W. Ayers, Hartford, Conn.

Finance Committee: A. N. Denman, Des Moines; B. M. Espy, Wilkesbarre, Pa.; C. N. Priddy, Leadville, Col.

Secretary and Treasurer: J. H. Decker, Hannibal, Mo.

The question came up as to whether associate members should be allowed at future meetings to exhibit their samples, and considerable discussion ensued. It was finally decided to invite them to be present at future sessions and explain their wares in a room outside the convention hall. The regular sessions then closed. In the afternoon St. Paul was visited and a carriage drive enjoyed about the city, the day closing with an informal banquet at the Hotel Ryan. This (Saturday) morning the members of the association are being driven about Minneapolis; this afternoon they are to go to Lake Minnetonka as the guests of the Minneapolis and St. Paul Water Boards, and this evening there is to be a banquet at Lake Minnetonka.

The following were among those in attendance the first day:

H. W. Ayers, Hartford, Conn.; G. E. Beach, Minneapolis; William Bowen, Oskaloosa, Iowa; Dexter Brackett, Boston; C. S. Brown, New York; Philip Buchner, St. Paul; G. A. Chandler, Kalamazoo, Mich.; J. H. Decker, Hannibal, Mo.; A. N. Denman, Des Moines, Iowa; J. M. Diven, Elmira, N. Y.; J. P. Donahue, Davenport, Iowa; B. M. Espy, Wilkesbarre, Pa.; J. T. Fanning,

Manchester, N. H.; L. H. Gardner New Orleans; A. H. Harrison, Stillwater; J. W. Henion, Minneapolis; Charles Hood, Burlington, Iowa; B. F. Jones, Kansas City; I. L. Lyman, Lincoln, Neb.; J. A. Mills, St. Catherine, Ont.; W. J. Milner, Birmingham, Ala.; William Molis, Muscatine, Iowa; G. W. Pearsons, Kansas City; C. N. Priddy, Leadville, Col.; W. G. Richards, Atlanta, Geo.; A. Rinker, Minneapolis; William Ryle, Paterson, N. J.; Matt Walsh, Minneapolis; R. D. Wirt, Independence, Mo. Also the following associate members: Bingham & Taylor, Buffalo; R. Beaumont; Chapman Valve Company, Indian Orchard, Mass.; J. B. Clow & Sons, Chicago; W. H. Marsh, New York; A. W. Morgan, Buffalo; National Meter Company, New York; National Tube Works, McKeesport, Pa.; Union Water Meter Company, Worcester, Mass.; R. D. Wood & Co., Philadelphia; H. R. Worthington, New York; W. H. Willard, Eau Claire, Wis.; Charles F. Loweth, St. Paul; John Wetter, East Saginaw, Mich.; H. E. Keeler, Chicago, Ill.

NATURAL FILTRATION.*

Question.—Is it practicable, as a rule, to depend upon a water-supply drawn from the gravel or sand under or adjacent to a stream?

The title of the subject allotted to me, and the question, seem to cover both quantity and quality.

The writer is very much inclined to generalize, perhaps too much so, but this question does not admit of a general answer. It would be very pleasant if an affirmative answer could be given, but, unfortunately, the most general one would be in the negative, and those favorable localities where such a supply can be obtained cannot be ignored.

The compass of this paper includes only such supplies as may be drawn from streams by the use of the natural ground as a filtering medium, but it is difficult to say just how far from a visible stream we may go, or whether those supplies which are drawn from invisible accumulations of water in areas of sand or gravel should not be included; they are a factor of as great value as the first, and as the means of obtaining a supply from them is similar, it seems proper to draw no line between them. The most important supply now drawn from underground in this manner is probably the auxiliary supply of Brooklyn, L. I. When this is examined it will be found to be only reaching for more of the same supply the city had before.

Ordinary sand or gravel of somewhat uniform character has interstices to the amount of thirty per cent. or more of its volume; compacted by the wash of the sea, the smaller particles naturally filling the voids between the larger, and further condensed by centuries of pressure from the superincumbent mass, it is doubtful if the voids exceed in the aggregate fifteen or twenty per cent.

On the sea beach of Long Island the writer has observed the water of a heavy storm sinking into the sand as fast as it fell; further inland, the surface-soil and vegetation retards the descent of the rainfall considerably, still a very large per cent. passes into the ground. The mean annual rainfall of this locality is some forty-two inches, of which it is probable that considerably more than fifty per cent. sinks, say twenty-four inches per annum, or enough to fill the voids in the water-bearing stratum to a depth of ten feet or more.

This moves on a gradient of from five to seven feet per mile, steadily seaward, enough passing off each year to make room for the yearly accretion.

Neglecting the study of its passage in detail, consider that a mass some 200 feet in depth takes on this motion. How much greater the movement is at the top we do not know, but as water moves in the line of least resistance, we may naturally consider that the greatest movement is near the surface. The average would be some 3,000 feet per year, or say nine feet per day.

At the wells, Professor Trowbridge found† the movement about one foot per hour. The same study shows that over 200 millions of gallons can be drawn annually from each square mile of such ground. This speed of flow of one foot per hour, given as the equivalent of a head or slope of from five to seven feet per mile, seems to be the movement of the contained water; that is, a movement of about two and one-half gallons through each square foot of the area traversed. This accords reasonably well with the former analysis, and is the writer's understanding of Professor Trowbridge's paper.

In artificial filtration we reach a maximum of some five times this amount; that is, a cubic foot of water per hour per square foot, with a clean filter, but soon decreasing to perhaps half this. It is evident that clean material will allow a much greater rate of motion through it than when it has become partially clogged; it is also evident that the motion of the water must be so slow that the suspended particles of impurity may be at liberty to attach themselves to any solid substance with which they come in contact on their journey, and not be again displaced by the action of the moving current.

The action of coagulants, alum, iron, muriatic acid, etc., seems to add very much to the rate of motion available for filtration, as would be naturally inferred, the aggregation of particles in this case making them much readier to seize and hold to any solid substances with which they come in contact. I think that Colonel L. H. Gardner, of New Orleans, was the first to suggest this as a practical aid to rapid filtration. I make the statement from my own understanding of the matter. Brother Gardner can deny the charge if he chooses, but otherwise I think we must hold him responsible; be this as it may,

it would seem that some of the principal builders of filters have been enabled by this simple addition to the ordinary process of filtration to add very largely to the efficiency of their filters.

The writer would here note that the experiments of Colonel Henry Flad, of St. Louis, and his own, show that when the action of filtration is upward instead of downward, a large body of still water being below the filter, the action of gravity on the particles rejected by the filter tends to deposit them in the still water, and the filter is much more effective and permanent than with the usual downward flow. It may be objected that the writer is wandering from his subject, but it is probable that the other writers on corresponding subjects will likewise wander from theirs, they having so much in common.

If we agree on any point it helps to establish that point; if we disagree, the meeting can note points of difference and make their own decisions, so that it cannot be considered as lost effort if we do to some extent trench on each other's subjects.

Under or on the banks of streams galleries have been built with a view to obtaining natural filtration; where the current is at times so strong as to wash from the bed of the stream the silt which has been deposited by a lower stage of water, the action of these galleries is similar to that of an artificial filter; where the surface of the sand or gravel is covered with a less pervious material, which remains *in situ*, it may be doubted whether the most of the supply comes from the stream.

Bear in mind, that all ground-water is primarily derived from rainfall; that in every case the stream is the natural drainage of the area traversed; that all ground-water tends in this direction; and it is evident that the rainfall on this ground, passing underground to the stream, is a greater or less factor of the supply. In the Northern States, water-bearing gravel-beds are found which may be very valuable as sources of supply.

At Peoria, Ill., a small well near the river was sunk through hard clay into a stratum of coarse gravel and boulders of unknown depth or extent. This yielded some three millions of gallons per day, and the amount available seems unlimited. So far as the writer is aware, the quality is good for city supply, but I have not heard of its having been utilized for this purpose.

In Allegheny County, New York, the Genesee River passes through a similar formation. At Binghamton, New York, water is drawn from a similar source. In Kansas, an immense deposit of sand and gravel seems to exist over a large area between the Platte and Kansas Rivers; the Kansas lying in lower ground draws a large portion of its waters from this source.

It would seem probable that these deposits occupy the channels of former rivers, and that we may find them away from as well as adjacent to streams, or some of them may be deposits of supposed glacial drifts like that of Long Island; in any case, when we find such a deposit it is worth testing if we are after a supply, but it is only by testing that either its quantity or quality can be known.

At Marshall, Mo., the writer found a water-bearing sand deposit some twenty feet in depth; its apparent breadth was something less than a mile, its length unknown. At a depth of thirty feet bits of wood, bone, coal, etc., showed very clearly that its origin was comparatively recent, but evidently prior to the present make-up of the country.

About a quarter of a mile below this well there was a living spring where the sand stratum cropped out in the ravine; during the sinking of the well, the pumping necessary for the work dried the spring, showing that the flow of water past us was arrested by the depletion.

The well was thirty-six feet in diameter and about the same in depth, the object of this size being to store water for sudden call. It seems able to supply permanently some 200,000 gallons of water per day.

The sides of the well for ten feet from the bottom are made of cants of 3-inch plank, kept one-eighth of an inch apart by veneers of wood, giving about 1,000 square feet of percolating area. During the sinking, however, all the water came from the bottom. The well was accordingly stopped three feet above the hard-pan bottom, and the sand and gravel covered with stone through which the water might find its way to the well. This is mentioned from the fact that it corresponds with the usual practice in filtering galleries.

In looking over the records of these it becomes evident that the bottom of these galleries is generally considered alone with regard to the entrance of water to them. Any inlet from the sides needs very careful guarding to prevent the admission of fine sand, which is more easily kept back in the bottom by the aid of gravity. Further than this it seems that these galleries are not largely increased in capacity by added dimensions; few of them are more than six feet in breadth. Where the volume of water in these galleries is of value to answer sudden call, the expense of their construction may be justifiable, otherwise the system of groups of small wells is cheaper, and will evidently yield all the water available in the locality.

The particular method employed to procure the supply is of less consequence than the fact that such a supply is available. The auxiliary supply of Brooklyn is drawn from between 300 and 400 ordinary driven wells, located for convenience at natural water-courses, the depths of wells and required lift being least in these localities. Such a group of wells will probably secure all the flow for a mile or more on either side of them, provided that their nearness to the sea-shore does not render them liable to deplete the water-level so much as to bring in sea-water.

Jamaica Bay, on Long Island, is an irregular indentation some four miles in width; outside of this is a long

sand point (Rockaway) averaging, perhaps, a quarter of a mile in breadth; the writer was called to provide a water-supply on this point.

As it was some seven miles to the nearest land where water could be obtained by the process adopted for the auxiliary supply of Brooklyn, or else four and one-half miles under the bay to the Brooklyn aqueduct, with a very doubtful chance of being allowed to draw such a supply from the ground there, the writer decided to try what could be found on the point itself, especially as works had to be built there anyway, and would not be lost if it was found afterwards necessary to go ashore for water.

The surface of the sand was irregular, sand dunes and low places alternating; where any considerable area existed, which was not overflowed by exceptional spring tides, the waters in the sand was found sweet and good, in the low places brackish. A well on good ground near the bay was used for the supply of steam tugs; during wet weather it gave good water; in dry weather it became brackish, evidently drawing a part of its supply from the sea at such times.

On this point the writer put down forty-six wells, dodging the low places and getting the best locations available over about a mile of ground lengthwise of the point.

The wells were open—that is, not connected by air-tight connections to the suction-main. They were found capable of yielding from twenty to thirty gallons per minute each, but were gauged to ten gallons, each well being sufficient to yield that supply without depleting the ground-water to the extent of the average rainfall.

The frictional resistance of the water on its passage from the more distant wells to the pumps was made as nearly equal to that from the nearest as practicable, and each well was further controlled by a valve between it and the suction-main; the first effort in pumping showed less than six inches difference in the height of water in all the wells attached.

They were from six to eight inches interior diameter. A part was made by casting the lower joint open, covering the cast-iron with heavy galvanized-iron wire cloth of one-quarter-inch mesh, and this with brass wire of fifty mesh. They were sunk by putting down an outer tube to the depth required, lowering this to place inside and drawing out the outer tube, as such tubes could not be sunk by driving without destroying the covering. The rest of the wells were of perforated tile. To put those down, an outer casing about one foot larger than the tile was sunk two feet deeper than intended for the depth of the well, two feet of the bottom was filled with gravel; the tile, of which about four feet was perforated, having been previously cemented in the joints, was now carefully placed in the centre of the casing and filled in with gravel to about two feet above the perforations; the outer tube being now withdrawn left the tile bedded in gravel. These were the best and cheapest. All the wells were sunk ten feet below the water-surface in the sand.

The reason of describing this plant at length is, that in several cases groups of wells like those driven alongside the Brooklyn aqueduct have been tried on the Atlantic seaboard and some of them have proved failures. The reason may be found in the actions of the well cited as used for the supply of tug-boats.

Where wells are connected to the pumping plant it can be readily seen that those nearest the pumps, by reason of difference in friction, will be drawn on most heavily, and the pumps cannot discriminate; therefore a depletion may occur which will lower the ground-water so much as to bring in sea-water.

With the open wells the plant can be examined and tested at any time, and if any well is yielding bad water it can be stopped without interfering with the rest.

I believe that I am the inventor of this system and that it does not interfere with any of the driven-well patents. You can dig the wells in any way you please and are entirely welcome to any information which this may give. I have not taken out any patents on it.

With regard to quality, we have, unfortunately, as uncertain a problem as in quantity. Filtration presupposes no objectionable qualities in the filtering medium. At Kalamazoo, Mich., the writer placed pumps over a natural spring which had been enlarged into a well. The flow was from sand, the water of crystal clearness, but so hard that it would deposit incrustations of lime on pebbles in the stream.

In the valley of the Missouri and Kansas at Kansas City hundreds of wells have been driven and sunk in the alluvial bottom land, and the apparent character of the same deposit which they penetrate would seem to insure good water, but not one, so far as the writer has knowledge, has given water of a satisfactory quality.

In sinking the sump well at Quindaro for the supply of Kansas City, we found the water rising and falling with the Missouri some 600 feet distant; the well, thirty feet in diameter, was able to yield some 500 gallons per minute, but notwithstanding it has been pumped all this year with a steam-pump for a supply of all the works, at times furnishing over 100 masons and concrete men, it retains its characteristic taste and the men will not drink it.

All along the Missouri wherever I have learned of the characteristics of the ground-water, the same report comes of unfitness for supply. Along the Mississippi below St. Louis where the planters thought they had solved the question of water-supply by driven wells, the outbreak of ague followed their use and they had to be abandoned.

It does not seem possible that all the wells so driven have proved bad, but the reports which the writer has heard for the last dozen years have been remarkably uniform.

* Abstracted from a paper by G. W. Pearsons, read before the Annual Session of the American Water-Works Association held in Minneapolis, July, 1887.

† See our issues of December 6, 1883 and May 28, 1887. - Ed.

The writer, therefore, considers natural filtration a very uncertain dependence, best probably where the distance traversed by the water is least, and depending very much on the purity of the filtering medium.

In some localities valuable supplies may be had from such sources, but in the alluvium of our Southern and Western rivers such a supply, if obtained, is liable to be doubtful in quality.

SHOULD STORAGE RESERVOIRS BE OPEN OR CLOSED?*

GENTLEMEN, in endeavoring to treat upon this very important question, I find myself at the very outset beset with difficulties and knotty problems far beyond the abilities of your humble servant to cope with. Although the title is short and comprehensive, still to enter into a complete digest of all the merits and demerits of both open and closed storage reservoirs requires not only a very careful study of causes and effects, covering a long period of time, but a considerable knowledge of chemistry in order to the more fully explain, to the comprehension of others, the full nature of such causes and effects. We find that we have a large and varied condition of circumstances to contend with, such as climate, capacity, quality of water, temperature, condition of atmosphere, material of which reservoir is constructed, and many other elements and conditions, making the subject one of too great a magnitude to attempt to cover by a single paper before your honorable association. However, I will endeavor to present for your consideration such facts as are readily obtainable with my limited knowledge and ability. In order to avail myself somewhat of the knowledge and experience of others, several months since I sent out over 100 circulars to water-works officials using reservoirs both open and closed, in the form of questions on his subject as follows:

1. Name and address of your system.
2. Is your reservoir open or closed?
3. Capacity of reservoir in gallons.
4. How built, of earth, brick or stone.
5. Source of supply of water.
6. Quality of water before entering reservoir.
7. Quality of water after standing in reservoir.
8. How often do you find it necessary to clean out reservoir?
9. What is the nature of matter taken out in cleaning?
10. Is reservoir troubled with frost; if so, to what extent?
11. Is water affected by action of sun; if so, how can it be prevented?
12. Is water in reservoir affected at times with bad odor or taste, such as fish, woody, musty, nauseous, cucumber, vegetable, or any other disagreeable odor or taste? if so, is it more disagreeable at one time of the year than another, and what time does it occur? how can it be remedied or prevented? is water ever polluted by fungus or mossy growth, such as algae, etc.? in what kind of water is this most likely to occur and how can it be prevented? Please give any other information in your possession bearing upon this subject.

To this I have, at this date, June 28, received several replies, many of which are answers in monosyllables to questions asked, still quite a number are more lengthy and contain much valuable information. I allude to a few of these, bearing more directly on the subject, as follows:

St. Louis, Mo.—Open reservoir; sixty million gallons capacity. Built of earth, stone facing, walls in centre of embankment. Source of supply, Missouri River. Has not yet been cleaned since built in 1871; about one foot of deposit. Water not affected by sun or atmosphere; no fungus or mossy growth, algae or other substance; no bad odor, taste or smell at any time.

Hannibal, Mo.—Open reservoir; one million and a half gallons capacity; water good before being pumped to reservoir; better after standing. Clean once a year; sediment, silt; not perceptibly affected by sun or atmosphere; no fungus or mossy growth; no bad taste or smell at any time.

Quincy, Ill.—Open reservoir, 22,000,000 gallons capacity, built of earth, stone lining. Source of supply, Mississippi River; not yet necessary to clean; in use five years. Has a vegetable growth in summer, a hairy, filthous moss; has a pronounced fishy taste in hot weather, but this does not seem to be due to anything in reservoir, as it is not apparent in water dipped up from reservoir; it is apparently due to some condition of the pipes. We have found it remedied largely by blowing off all the fire-hydrants, and have concluded that the dead or bilgy water in the hydrant connections with the mains gave rise to it.

Muscatine, Iowa.—Reservoir closed; capacity 2,000,000 gallons; built of earth, brick and cement. Source of supply, Mississippi River. Clean out twice a year; sediment, river mud. No bad effect from sun or atmosphere, as after standing a week at a time water seems as good and pure as ever. Reservoir 20 feet deep, sides 128x140 feet, slope 1½ to 1.

William Molis, Superintendent, writes: "In regard to bad taste or odor, we have never experienced any trouble in that way; the only trouble we have is a green scum, a vegetable growth of cryptogamous nature, full of animalcula which an exposure to sun, out of water, gives forth a fetid odor. This growth never goes below the surface, always found on top; the growth is or develops into the snail order, as found by experiment by letting them hatch

out under a glass case, but then we have not found the first sign of them in our pipes, and, on cleaning out reservoir, it disappears entirely. I think all reservoirs in this section of country are affected in the same way."

Savanna, Ills.—Reservoir closed, built of stone and cement; capacity, 800,000 gallons. Source of supply, Mississippi River; at times a little muddy and a slight swampy nature; after standing find water much improved.

W. H. Griffith, Chairman Board of Water Commissioners, writes: "At present, use of water about 1,000,000 gallons per week. We find that cleaning out once a year is sufficient. Sediment, a soft mud of a dark gray color. Have had no trouble with frost whatever. As to the action and effect that sun has on water stored in large reservoirs, my experience has not been very large, still I think the heat of the sun does create a growth of green fungus matter. On a recent visit to St. Catharines, Ont., where the superintendent is a relative of mine, I find that they are troubled with a heavy growth of moss, so that it was difficult to get a small boat through, although the reservoir was thoroughly cleaned every season at great expense. My preventive would be to construct a reservoir such as we have here, cemented on inside, and with a good roof. Clean it out as often as necessary and the trouble of fungus or mossy growth will be obviated."

Decorah, Iowa.—Reservoir closed; capacity, 500,000 gallons; stone, cemented; source of supply, well. Not cleaned since built in 1881. An analysis shows it to be the best water in the city, no bad taste, odor, or fungus growth of any kind.

R. B. Tuttle, Chairman of Water-Works Committee at time works were built in 1881, writes: "I am not a member of City Council at present, but believe that with open reservoirs the utmost care has to be taken to prevent the water from being contaminated by fungus matter that would be prejudicial to the health of those using it. At Sioux City, Iowa, their reservoir is enclosed with a wire screen, and in addition, a man employed by the year to guard it. Diphtheria prevailed, to some extent, in Decorah last winter, and an analysis of the water from the different sources of supply showed that the water taken from the reservoir was the purest that could be obtained. I wish I was more fully able to give you information on a matter of such great importance."

D. C. Fry, Superintendent Water-Works, Jacksonville, Ill., writes: "Our reservoirs are all open; the impounding reservoir holds 80,000,000 gallons, fed from surface water, springs, and from tilled land. Giving a description of the manner reservoirs are built. Have cleaned reservoir every two years; sediment, mud, black dirt, and fish. Are not troubled with frost. Water is affected in distributing reservoir a little by the sun in the month of August; not affected with bad odor. We pump into distributing reservoir every day, which keeps it pure; if allowed to stand for a long time it would become stagnant."

Newport, Ky.—B. P. Merton, Superintendent, writes: "Reservoir open. Capacity 40,000,000 gallons; source of supply, Ohio River; does not need cleaning, although in use fourteen years. Since works have been in operation, there have been but very few occasions when water was affected by bad odor or taste; in those instances it was decidedly fishy. As consumption has increased, and more frequent renewals of supply to the basins, the trouble has ceased. It is about five years since the last case. Have never had any trouble, except in mild or warm weather."

Catskill, N. Y.—Reservoir open; capacity, 4,500,000 gallons; source of supply, Hudson River. F. P. Smith, Superintendent, writes: "Reservoir has not been cleaned since built in 1885; do not consider that action of sun has any effect on water. Water has been affected once in each year since works were put in operation with a fishy odor and an oily, nauseous taste, commencing about May 15 and disappearing in about two weeks. This spring the taste and smell came promptly on time, and I immediately had the mains thoroughly flushed; the taste and smell continued only two days after. My opinion, however, is that the condition of the water is due to other cause than filthy water-mains; but I am not at present prepared to give a decided opinion as to what the cause is."

Akron, O.—H. C. Starr, Secretary and Treasurer, writes: "I can answer some of your easy questions, but the hard ones I will let some one else wrestle with. Reservoir open, 6,000,000 gallons capacity. Source of supply, lake and well; quality about the same as Lake Erie. We keep water in motion by pumping, still, when water is low and sun shining, there will a substance grow and rise on the water of a mossy growth, or perhaps algae. Two years ago we had a severe dose of fishy taste and smell, and have had it mildly at various times since. As to the cause, doctors disagree."

Ithaca, N. Y.—J. L. Morris, of Cornell University, writes: "Reservoir open; capacity, 1,000,000 gallons; supply from Fall Creek; clean out twice a year. Water somewhat affected by sun; remedied by pumping in and opening overflow; sometimes a fishy taste in summer-time; no moss; remedy, open hydrants and blow off. Four open reservoirs well fenced in, too expensive to cover them. Am too busy to write more."

Lynn, Mass.—Reservoir open; capacity, 20,000,000 gallons; source of supply, small streams; cleaned once in thirteen years. Daniel Walden, Superintendent, writes: "After explaining impounding basins, our theory has been that the bad odor and taste came from the ponds being newly made, and our experience would seem to confirm that theory."

Ottumwa, Iowa.—Reservoir open; capacity, 2,000,000

gallons; supply, river; cleaned once in five years. In regard to bad odor and taste, most of them are likely to occur in extreme hot and long drouths. The fishy taste we experienced one."

Cleveland, Ohio.—Reservoir open; capacity, 80,000,000 gallons; supply, Lake Erie; twice in twenty years had the fishy taste in month of July; found water in Lake similarly affected; was accompanied both times by rank growth of algae in reservoir and protracted period of still water in Lake.

Oswego, N. Y.—Reservoir open; capacity, 7,500,000 gallons; supply, Oswego River, with filters; clean reservoir once in two or three years. Months of June, July and August sometimes gives a fishy or cucumber flavor; cannot be remedied except by expensive filtering and aeration. Very little fungus or mossy growth of algae, etc.; remedied by drawing off water, letting sun kill the growth, then clean it out.

Grand Rapids, Mich.—A. C. Sekell writes: "Reservoir open; capacity, 6,000,000 gallons; had fishy taste in times past, but know of no careful studies relating to the cause. Have about 10 miles of wooden pipes in which are many fresh-water sponges. My opinion is that storage reservoirs holding stream or surface water may properly be left open when of large extent and having at least twenty feet depth; when the supply is ground or spring water, storage basins should be covered in as tightly as possible, to the exclusion of all light and air. This, I think, was the opinion of the late Prof. Nichols."

Paterson, N. J.—Four reservoirs, open; capacity, 50,000,000 gallons; supply, Passaic River. When river is low water tastes fishy; river is fed by springs. Pump each day what is consumed, and as water is constantly changing are never troubled with algae.

New Brunswick, N. J.—A. J. Jones, Superintendent, writes: "Reservoir open; capacity, 15,000,000 gallons. Description and drawing showing how built. Clean out once a year; source of supply, Lawrence Brook; of good quality and soft; contains at certain seasons much vegetable matter in suspension, which we believe to be the principal cause of the unpleasant odor and taste occasionally noticed, and which has been the cause of much complaint in past seasons or until 1883, since which it has gradually improved; the taste was of the fishy, woody, cucumber variety of which you speak, and although at times coming as early as June, is not generally noticed until July or August. It is not noticeable in the lake from which the water is drawn, nor was it noticed there when the water in reservoir was particularly objectionable, which led me to seek the cause between the lake and reservoir. After many fruitless efforts in other directions and some attempts to remove it or purify it without filtering the water in the reservoir, I found by experiment that the water, if kept quiet under pressure for two or three days, when released would emit the odor complained of, while if kept in an open vessel for the same period of time appeared to remain in good condition. We then stopped the pumps and left the water standing in the mains for from forty-eight to seventy-two hours, and as a rule it spoiled; since then we never (if possible to avoid it) permit the water to stand in the pumping mains longer than twelve hours, and have had scarcely any trouble, although we sometimes get a trace of it. If our engines are not in operation for a day or two, which is frequently the case with us, we draw off all the water from the pumping mains before starting the pumps again. In the distributing, and particularly where the circulation is not as perfect as it should be, we resort to the frequent blowing off at hydrants. Our reservoirs are kept entirely free from any vegetable growth. I do not offer the foregoing as a solution of the difficulty by any means, but merely give you the benefit of our investigations. I regret my inability to furnish you with more on the subject which might be of service to you in preparing what must certainly form an interesting paper."

Pierre, Dakota.—Superintendent J. W. Troy writes: "Reservoir closed; capacity, 1,000,000 gallons; source of supply, settling well near Missouri River; quality of water, pure and clear as it goes to reservoir. Do not think it would be necessary to clean reservoir oftener than once in two years, as after pumping two years drew off water to clean it, but found nothing to clean out; pails held all the sediment, which was fine sand carried through with the water from settling well. Water in well when not protected from sun develops a fungus or mossy growth, but when protected from sun remains pure. This I have found by experimenting since the subject was discussed at Denver last year. Water in reservoir is not affected at any time with any disagreeable odor or taste, but if drawn off in vessels exposed to sun and air, it would assume a color resembling water that leather had been soaked in, and have odor resembling old rubber. I have made chemical tests of water here and find quite a percentage of magnesia or chalk, with slight trace of iron and very slight trace of organic matter."

Nashville, Tenn.—George Ryer, Superintendent, writes: "Reservoir open; capacity, 2,500,000 gallons; source of supply, Cumberland River; very muddy after heavy rains; clean out once a year; sediment eight to twelve inches deep; water at its worst will settle clear and pure in forty-eight hours. Sediment, composed of sand and clay, becomes offensive when exposed to sun and air. No bad taste or smell at any time and but little mossy growth, and only in July and August, when water is perfectly clear; have called attention of health officer to this growth, and he says it is not deleterious to health, as it is the same as found on stones in pure streams. As to covering of reservoirs, it is my opinion that much depends on localities. If it is distant

*A paper by G. E. Beach, read at the annual convention of American Water-Works Association, Minneapolis, Minn., July, 1887.

from thickly populated districts and manufactories, I do not think it necessary to have them covered, only in very cold climates; if, however they are located within or near manufactories then it may be best to cover them. The affinity which water has for foul gases is readily shown by leaving an open vessel of water in a sleeping apartment where ventilation is poor, and after one night the water becomes very obnoxious. Chemistry informs me that strong traces of ammonia are found in dew taken from grass at considerable distance from manufactories using bituminous coal, which contains considerable free ammonia. This being the case it strikes me that with the great affinity which water has for this particular gas, that large bodies of water would absorb considerable, especially in places where large amounts of soft coal is used as fuel."

From a careful consideration of the foregoing reports and a personal knowledge of the facts connected with many other water-works and reservoirs, we are led to the following conclusions—viz.: That pure water as taken from the earth, either from wells or springs, is by nature very productive of both animal and vegetable life, and that under favorable conditions these productions are spontaneous and without previous germination; still there are certain conditions required to spontaneously produce these growths. Some of the conditions required are as follows—viz.: That the water itself must be practically pure; that it must be of a temperature of at least 50° Fah.; that it must be exposed to sunlight and air; that it must be without pressure or at least not to exceed five to eight pounds pressure per square inch; that it must be without contamination from sewage matter. As an illustration, where reservoirs or basins are over fifteen to twenty feet deep, algae is not known in the water, neither is it known in water polluted with sewage, although the mossy growth may exist in water more polluted than that which would produce algae; as, for instance, the water of the Mississippi River, which carries the sewage of millions of people and domestic animals, is sufficiently polluted to prevent the growth of algae, still in some instances the mossy growth partially thrives; still the water is generally considered fair for domestic purposes. As to what algae is, whether vegetable or animal growth, it is not positively known, but of either class it is evident that it is of the lowest order and produced spontaneously by the action of the sun upon pure water of no great depth. It appears to commence its growth in the early springtime, thriving till May or June, when it appears to mature and release its hold upon the bottoms and sides of reservoirs, rising to the surface and decaying in July and August and producing the nauseous odor and taste so often alluded to; since it would follow that the presence of algae in water is a good evidence of its purity, and to a certain extent the presence of the mossy growth alluded to is also evidence of water comparatively pure. If the above theory is correct the next question to be considered is how to prevent such growth in pure water. This can be done in several ways. First, have reservoirs deep; second, have them covered so as to exclude sunlight and air, which materially aid in keeping temperature at its lowest point; and again by admitting a sufficient amount of sewage or filth to prevent its growth. It is no doubt a fact that many persons in charge of water-works have declined to answer questions on this subject, where the water produced such offensive odor and taste, preferring that the public should be kept in ignorance of the fact if possible, rather than aid in solving an important problem. On May 8 last the writer obtained from a small lake, known as Buell's Lake, near St. Peter, Minn., a quantity of the above-described mossy growth and algae, and has since kept it in Mississippi River water, changing water occasionally. The algae disappeared in a very few days, while the mossy growth partially thrives. The lake referred to is of an area of about eighteen acres, with a varying depth of two to eight feet. Above lake is supposed to be fed by springs, having no visible inlet or outlet, and having a water-shed of less than five acres, the waters of which, from the driest to the dampest seasons, have never been known to vary to exceed one foot. This mossy growth grew thickest on the side of lake from which the springs were supposed to be, and where the depth was least, none growing where water was more than six feet deep. Algae was only found near where the springs were supposed to be located. Samples of this mossy growth will be shown members of convention; an analysis of the waters of above lake has been made but not yet received; if received in time will be submitted to convention.

Now to the main question, Should storage reservoirs be open or closed? it would appear that if water is taken from the ground, either from wells or springs, that it is very important that the reservoirs should be completely covered so as to exclude sunlight and heat, but well ventilated; while water taken from rivers and lakes it is of much less importance, especially when stored in large bodies. Still, where it can be practically done, it would no doubt be much better to exclude sunlight from all storage reservoirs.

THE Vapor Stove Manufacturers' Association of the United States met in Cleveland July 7. Mr. John Ringen, of St. Louis, President of the association, delivered the annual address, and Mr. George Kahle, also of St. Louis, Secretary, read the annual report. The following committee on "Schedule of Prices and Discounts" for the following year was appointed:

William Brandon, of St. Louis; Garson Myers, of Chicago; J. S. Halterman, of Detroit; W. M. Lottridge, and J. L. Alcott, of Cleveland.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

SIR ROBERT RAWLINSON ON "LEAVES OF ABSENCE FOR MUNICIPAL ENGINEERS."

LONDON, 28th June, 1887.

SIR: In your journal of the 18th inst. I notice a kindly leading article on "Leaves of Absence for Municipal Engineers," with the tone and spirit of which I most heartily agree.

Municipal members have a right to be themselves diligent in business and careful of their own time and money, and, consequently, they only act consistently when they are equally careful of official time and money; but both in private and in public life a man may be niggardly and tyrannical, wedding himself to the life of a drudge, and having no consideration for those whose misfortune it is to have to serve him. Heaping up riches, not knowing nor indeed caring who may gather them. Such men may be recommended, each day, to read some passage from the burial service. But probably it would be in vain. Such a man,* whose whole life was spent in heaping up riches, and in refusing every claim made upon him for charity, was once told that he must leave his money to some one, and he the recipient would spend it. This man replied: "He may do whatever he d— he likes with it, but he will never have half the pleasure in spending it that I have in saving it." There can be no beneficial arguing with such men. But, I may be asked, "What has this to do with Leaves of Absence for Municipal Engineers?" Well, my answer is, "A good deal." I wish my remarks and illustrations to be a protest against skinflint narrow-mindedness, and an incentive to moderation in all things, with a sympathetic liberality extending to servants in all ranks and classes. The old childish proverb may be quoted, as regards municipal servants: "All work and no play makes Jack a dull boy." Consequently, the spirit of this old proverb may be made applicable to municipal surveyors. One gin-horse round of grinding work will lead to dullness, where the opposite quality is very much needed. Why, even in our old country, Government and municipal officials have annual leave of absence, amounting to six weeks, as may be arranged for, out of each year; and on special occasions of impaired health, extended to six months on full pay. I approve, sir, of the suggestion in your leader, and most heartily second your plan for annual leave of absence on full pay to local board and municipal surveyors, so that they may enjoy leisure to gain health, and at the same time be enabled to inspect works, in which they are interested, under various conditions. Sanitary engineering is a new science, and as its main purpose is to make health, comfort, and a prolongation of life practicable, its study to a useful purpose must be important.

I have the honor to be, dear Mr. Editor,
Yours very truly, ROBERT RAWLINSON,
Chief Inspector, Local Government Board, England.

DRYING PLASTER IN A HOT-AIR KILN.

SYRACUSE, N. Y., July 5, 1887.

SIR: Having from time to time read your answers to different correspondents you can enlighten me as to why a kiln that I put in does not work. The material in question is much like wet clay and must be dried as quick as possible, as it is a chemical that is used for making wall plaster, and if it is not dried quick the virtue of the chemical is killed, as a chemical action takes place in the pans and causes it to set as hard as stone, whereas, if it is dried quickly it dries in a powder. The greatest difficulty I have is to separate the moisture from the material, as just as soon as it begins to raise a vapor it settles back in the pans, thus keeping it continually damp. The material in question has a strong tendency to hold moisture rather than to throw it off. The kiln in question is 18 feet long, 5 feet high, and 2 feet 5 inches deep, containing fifty-six pans for drying purposes; said pans are run in on tracks after the design of a dresser, with an air-space of 2½ inches between each pan. The pans are eight tiers high, and between each tier there is an air-space of 3 inches running from the coil in the bottom of kiln to the top for the heat to rise through. The pans in said tiers are 2 inches deep with the material in them, 1 inch deep virtually, leaving a space of 3½ inches from bottom of one pan to the top of material in the other.

There is in said kiln thirty-six 1-inch pipes seventeen

* The man who made the remarks quoted was an English city Alderman, who built insanitary cottages for workmen, the combined rents bringing in about £14,000 per annum, and he was Chairman of the Sanitary Committee. R. R.

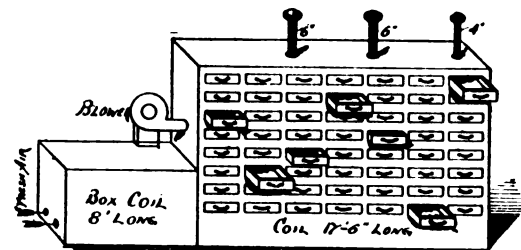
feet six inches long—equal to 210 square feet of heating surface; besides this there is a box-coil eight feet long, containing sixty pipes—equal to 160 square feet of heating surface—the heat from which is carried to kiln by the use of an 18-inch exhaust fan-blower, which forces heated air into kiln and causes a circulation of air. Out of the top of the kiln I have three ventilators for carrying out the vapor arising from the material as it dries. The material dries now in twenty-four hours as a rule, but has dried in sixteen hours, which is too long a time. I should like to know why it does not dry quicker. There must certainly be heat enough, as the coils are connected direct with boiler, which is run at from forty-five to sixty pounds pressure. I should like to have the material dry in about two or three hours at the outside. If you have any idea as to how I could utilize the kiln and have it do this I should like to have you suggest it; or whether you think it can ever be done so as to do the work required of it. Hoping that you can suggest something,

I remain yours, etc.,

JAMES MORRISON.

P. S.—I send inclosed a sketch of the kiln.

[The problem of drying so much wet material of this nature in so short a time as three hours or thereabouts is one not readily solved by air-currents warmed by steam-pipes, and what you really ask us is to design a drier of a special purpose. The most we can do, however, in such a matter is to present the difficulties that have to be overcome, leaving the details to the inventor.]



The means of drying may be classed under two heads: (1) Evaporating water at low temperatures by absorption into the atmosphere as aqueous vapor; (2) evaporation of water by temperatures above 212° Fah. by driving it off into the atmosphere as steam. By either of these methods for every pound of water converted into vapor or steam 1,000 units of heat (very nearly) is made latent and must be supplied from the heat of either the fire, the steam, the air, or the surrounding objects.

In your case your drawers have a bottom area of about 360 square feet, and if filled with wet, pasty material, one inch thick, will make thirty cubic feet of paste, one-half of which in bulk, it is reasonable to assume, is water, leaving fifteen cubic feet of water to be evaporated, or in other words, 937.5 pounds of water, the equal of 937,500 heat-units, which will represent about 100 pounds in good anthracite coal, burned under a boiler. In other words, if you had this much water in a boiler, or pot, and had to boil it away into the atmosphere, with a fire under it, you would have to burn 100 pounds of good coal in the most scientific manner no matter what the time was. If you wanted to do it in three hours, you must have a boiler of from ten to twelve horse-power, as steam-boilers are rated, and you must burn under it thirty-three pounds of coal each hour.

If you attempt to dry it by warm air the same amount of heat-units will be absorbed and made latent by the "drying up" of the water, and this heat must be abstracted from the air; and as probably one-half the total heat in the air cannot be so abstracted during its passage over the material to be dried, it is reasonable to assume that air containing about 2,000,000 units of heat must be passed during the time of drying, and in this our estimate may be much too low. Approximately, a heat-unit warms 50 cubic feet of air one degree, and if it is warmed 100 degrees by contact with the coils, we have 2,000,000 H. U. $\times 50 + 100 = 1,000,000$ cubic feet of air as the least quantity that must pass in contact with the surface of the materials to be dried, to surrender half its heat for evaporating the water alone.

This is not all, however, for we must see if the 1,000,000 cubic feet of air is capable of taking away the whole of the water in addition to supplying the heat to evaporate it. In this case we may assume the air to enter the heating-chamber at 40° Fah. and be raised to 140° Fah., and then cooled to 90° by surrendering half its heat to the vapor of water while passing through the chamber. Its capacity, afterwards, for holding vapor in suspension is the same as air warmed from 40° to 90°, and under its best conditions—say in winter-time—will be ten grains to the cubic foot, and in summer probably six grains per cubic foot. Taking the latter, then, we have 6,000,000 grains of water (or 857 pounds), that the 1,000,000 cubic feet of air is able to carry off in the summer time if it is doing its utmost. It shows, therefore, it is not quite equal to the task of taking away the 935 pounds of water first assumed, and that probably 2,000,000 cubic feet of air entering the box at from 120° to 140° Fah. will not be an overestimate to do the work you are trying to do by the plant shown in cut. To do it in three hours will require 666,666 cubic feet of air per hour, and a fan of the Briggs type about six feet in diameter, or some other good fan that will pass that amount in an hour.]



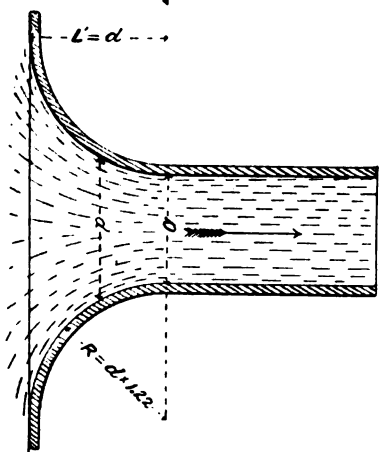
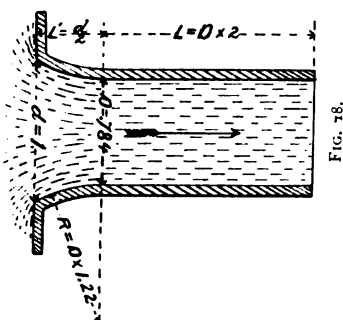
HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. VII.

(Continued from page 45.)

WHEN a pipe enters or passes in through the side of a reservoir or boiler for a short distance the loss caused to the flow of the water by entry is even greater than with a pipe flush with the inside of the tank or boiler, and this loss has been found by experiment to be over .3 of the whole, decreasing the flow of the water one-eighth over a pipe that is flush, and for this reason pipes should never be carried through the side of a boiler or through a junc-



tion or fitting so as to make a projection, unless the obstruction to the flow is no objection or that there is some object of greater importance to be obtained.

When the water leaves the side or top of a boiler through a tapered circular nozzle, the loss by entry is less than when the pipe is parallel at the commencement. When this nozzle or truncated cone has a length of half its greatest (or base) diameter, and its smallest diameter .784

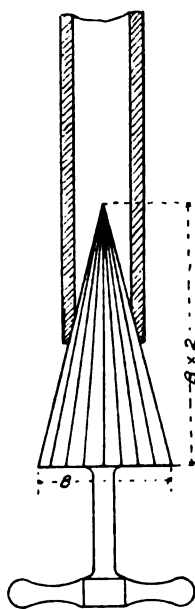


FIG. 19 1/2.

of its base, the flow of water will be augmented as it passes the smaller end, until it approaches to within less than .05 of the theoretical flow; and if the curve of the side of the cone is 1.22 of the diameter of the pipe, as shown in

Fig. 18, the loss will be reduced to about .025 of the theoretical, or a quantity almost too small to take into consideration in ordinary calculations.

If the smallest diameter of the cone therefore forms the area of the flow-pipe the loss of flow by entry is reduced to a minimum, and Fig. 18 gives probably the best proportions for points of entry into pipes or departure from boilers or large fittings, and is the proper form and shape for boiler outlets; and it also could be used to advantage whenever it became necessary to use enlargements or contractions of a pipe, as abruptness in the contractions affect the flow detrimentally, as it increases friction, and for that reason, even with the best form of contracted vein, a coefficient of .05 should be allowed for entry in close calculations even with the best form of vein considered.

Figure 16 shows the *vena-contracta* carried to the extreme. It makes a trumpet-shaped point of entry, which looks well and symmetrical, but withal little if any more water will pass into it under the same pressure than will into a vein similar to the one shown in Fig. 18, and this fact should be enough to impress on us the advantage derived by having the ends of all wrought-iron pipe, or in fact any pipe for hot water, apparatus, reamed to a thin edge with a triangular or conical reamer whose length is just twice its base, as shown in Fig. 19 1/2. In thick pipes, or ones of small diameter that are relatively thick enough can be taken from them in this way to give almost the best form of *vena-contracta* and it will be of immense advantage for elbows and all fittings, not excepting couplings.

The accompanying table No. I. gives the greatest theoretical quantity of water in U. S. gallons that will pass through a short tube whose length is about two diameters, as (shown in Fig. 18,) provided the water is led to it through a contracted vein (termed *vena-contracta*) as there shown.

Diameter of pipe in inches.	HEAD OF WATER IN INCHES.														
	¼	½	¾	1	2	3	4	5	6	7	8	9	10	11	12
1.....	1.64	2.32	3.27	4.41	5.78	7.37	9.17	11.17	13.37	15.77	18.37	21.17	24.17	27.37	30.77
1 1/4.....	2.00	2.84	3.92	5.24	6.80	8.57	10.54	12.71	15.07	17.62	20.37	23.32	26.47	29.82	33.37
1 1/2.....	2.25	3.24	4.44	5.92	7.64	9.57	11.71	14.06	16.62	19.37	22.32	25.47	28.82	32.37	36.12
1 3/4.....	2.45	3.56	4.88	6.48	8.32	10.37	12.62	15.07	17.72	20.57	23.62	26.87	30.32	33.97	37.82
2.....	2.65	3.88	5.32	7.04	9.00	11.17	13.54	16.11	18.87	21.82	24.97	28.32	31.87	35.62	39.57
2 1/4.....	2.85	4.20	5.76	7.60	9.76	12.02	14.49	17.16	19.92	22.87	25.92	29.17	32.62	36.27	40.12
2 1/2.....	3.00	4.48	6.16	8.16	10.56	13.06	15.62	18.37	21.22	24.17	27.22	30.47	33.92	37.57	41.42
2 3/4.....	3.15	4.76	6.56	8.64	11.12	13.62	16.27	19.02	21.87	24.82	27.87	31.02	34.27	37.72	41.27
3.....	3.30	5.04	6.96	9.12	11.76	14.46	17.21	20.06	22.91	25.86	28.91	32.06	35.31	38.76	42.41
3 1/4.....	3.45	5.36	7.44	9.84	12.64	15.44	18.29	21.14	24.09	27.04	30.09	33.24	36.49	39.94	43.39
3 1/2.....	3.60	5.68	7.84	10.32	13.20	16.00	18.84	21.69	24.54	27.49	30.44	33.69	36.94	40.39	43.94
3 3/4.....	3.75	6.00	8.24	10.80	13.76	16.56	19.40	22.25	25.10	28.05	31.00	34.25	37.50	40.75	44.30
4.....	3.90	6.32	8.64	11.28	14.32	17.12	19.96	22.81	25.66	28.61	31.56	34.81	38.06	41.31	44.76
4 1/4.....	4.05	6.64	9.04	11.76	14.88	17.68	20.52	23.37	26.22	29.17	32.12	35.37	38.62	41.87	45.42
4 1/2.....	4.20	6.96	9.44	12.24	15.44	18.24	21.08	23.93	26.78	29.73	32.68	35.93	39.18	42.43	46.08
4 3/4.....	4.35	7.28	9.84	12.72	15.92	18.80	21.64	24.49	27.34	30.29	33.24	36.49	39.74	42.99	46.74
5.....	4.50	7.60	10.24	13.20	16.48	19.36	22.20	25.05	27.90	30.85	33.80	36.85	39.90	43.05	47.30
5 1/4.....	4.65	7.92	10.64	13.68	17.04	19.92	22.76	25.61	28.46	31.41	34.36	37.41	40.46	43.61	47.86
5 1/2.....	4.80	8.24	11.04	14.16	17.60	20.48	23.32	26.17	29.02	31.97	34.92	37.97	41.02	44.07	48.32
5 3/4.....	4.95	8.56	11.44	14.64	18.16	21.04	23.88	26.73	29.58	32.53	35.48	38.53	41.58	44.63	48.88
6.....	5.10	8.88	11.84	15.12	18.72	21.60	24.44	27.29	30.14	33.09	36.04	39.09	42.14	45.19	49.44
6 1/4.....	5.25	9.20	12.24	15.60	19.28	22.16	24.96	27.85	30.70	33.65	36.60	39.65	42.70	45.75	50.00
6 1/2.....	5.40	9.52	12.64	16.08	19.84	22.72	25.52	28.41	31.26	34.21	37.26	40.31	43.36	46.41	50.66
6 3/4.....	5.55	9.84	13.04	16.56	20.40	23.28	26.08	28.97	31.82	34.77	37.72	40.77	43.82	46.87	51.22
7.....	5.70	10.16	13.44	17.04	20.96	23.84	26.64	29.53	32.38	35.33	38.28	41.33	44.38	47.43	51.78
7 1/4.....	5.85	10.48	13.84	17.52	21.52	24.40	27.20	30.09	32.94	35.89	38.84	41.89	44.94	47.99	52.34
7 1/2.....	6.00	10.80	14.24	18.00	22.08	24.96	27.76	30.65	33.50	36.45	39.40	42.45	45.50	48.55	52.90
7 3/4.....	6.15	11.12	14.64	18.48	22.64	25.52	28.32	31.21	34.06	37.01	40.06	43.11	46.16	49.21	53.46
8.....	6.30	11.44	15.04	18.96	23.20	26.08	28.88	31.77	34.62	37.57	40.57	43.62	46.67	49.72	54.02
8 1/4.....	6.45	11.76	15.44	19.44	23.76	26.64	29.44	32.33	35.18	38.13	41.13	44.18	47.23	50.28	54.58
8 1/2.....	6.60	12.08	15.84	19.92	24.32	27.20	30.00	32.89	35.74	38.69	41.69	44.74	47.79	50.84	55.14
8 3/4.....	6.75	12.40	16.24	20.40	24.88	27.76	30.56	33.45	36.30	39.25	42.25	45.30	48.35	51.40	55.70
9.....	6.90	12.72	16.64	20.88	25.44	28.32	31.12	34.01	36.86	39.81	42.81	45.86	48.91	51.96	56.26
9 1/4.....	7.05	13.04	17.04	21.36	26.00	28.88	31.68	34.57	37.42	40.37	43.37	46.42	49.47	52.52	56.82
9 1/2.....	7.20	13.36	17.44	21.84	26.56	29.44	32.24	35.13	37.98	40.93	43.93	46.98	50.03	53.08	57.38
9 3/4.....	7.35	13.68	17.84	22.32	27.12	29.96	32.80	35.69	38.54	41.49	44.49	47.54	50.59	53.64	57.94
10.....	7.50	14.00	18.24	22.80	27.68	30.52	33.36	36.25	39.10	42.05	45.05	48.10	51.15	54.20	58.50
10 1/4.....	7.65	14.32	18.64	23.28	28.24	31.08	33.92	36.81	39.66	42.61	45.61	48.66	51.71	54.76	59.06
10 1/2.....	7.80	14.64	19.04	23.76	28.80	31.64	34.48	37.37	40.22	43.17	46.17	49.22	52.27	55.32	59.62
10 3/4.....	7.95	14.96	19.44	24.24	29.36	32.20	35.04	37.93	40.78	43.73	46.73	49.78	52.83	55.88	60.18
11.....	8.10	15.28	19.84	24.72	29.92	32.76	35.60	38.49	41.34	44.29	47.29	50.34	53.39	56.44	60.74
11 1/4.....	8.25	15.60	20.24	25.20	30.48	33.32	36.16	39.05	41.90	44.85	47.85	50.90	53.95	57.00	61.30
11 1/2.....	8.40	15.92	20.64	25.68	31.04	33.88	36.72	39.61	42.46	45.41	48.41	51.46	54.51	57.56	61.86
11 3/4.....	8.55	16.24	21.04	26.16	31.60	34.44	37.28	40.17	43.02	45.97	48.97	52.02	55.07	58.12	62.42
12.....	8.70	16.56	21.44	26.64	32.16	35.00	37.84	40.73	43.58	46.53	49.53	52.58	55.63	58.68	62.98
12 1/4.....	8.85	16.88	21.84	27.12	32.72	35.56	38.40	41.29	44.14	47.09	50.09	53.14	56.19	59.24	63.54
12 1/2.....	9.00	17.20	22.24	27.60	33.28	36.12	38.96	41.85	44.70	47.65	50.65	53.70	56.75	59.80	64.10
12 3/4.....	9.15	17.52	22.64	28.08	33.84	36.68	39.52	42.41	45.26	48.21	51.21	54.26	57.31	60.36	64.66
13.....	9.30	17.84	23.04	28.56	34.40	37.24	40.08	42.97	45.82	48.77	51.77	54.82	57.87	60.92	65.22
13 1/4.....	9.45	18.16	23.44	29.04	34.96	37.80	40.64	43.53	46.38	49.33	52.33	55.38	58.43	61.48	65.78
13 1/2.....	9.60	18.48	23.84	29.52	35.52	38.36	41.20	44.09	46.94	49.89	52.89	55.94	58.99	62.04	66.34
13 3/4.....	9.75	18.80	24.24	30.00	36.08	38.92	41.76	44.65	47.50	50.45	53.45	56.50	59.55	62.60	66.90
14.....	9.90	19.12	24.64	30.48	36.64	39.48	42.32	45.21	48.06	51.01	54.01	57.06	60.11	63.16	67.46
14 1/4.....	10.05	19.44	25.04	30.96	37.20	40.04	42.88	45.77	48.62	51.57	54.57	57.62	60.67	63.72	68.02
14 1/2.....	10.20	19.76	25.44	31.44	37.76	40.60	43.44	46.33	49.18	52.13	55.13	58.18	61.23	64.28	68.58
14 3/4.....	10.35	20.08	25.84	31.92	38.32	41.16	44.00	46.89	49.74	52.69	55.69	58.74	61.79	64.84	69.14
15.....	10.50	20.40	26.24	32.40	38.88	41.72	44.56	47.45	50.30	53.25	56.25	59.30	62.35	65.40	69.70
15 1/4.....	10.65	20.72	26.64	32.88	39.44	42.28	45.12	48.01	50.86	53.81	56.81	59.86	62.91	65.96	70.26
15 1/2.....	10.80	21.04	27.04	33.36	39.96	42.84	45.68	48.57	51.42	54.37	57.37	60.42	63.47	66.52	70.82
15 3/4.....	10.95	21.36	27.44	33.84	40.52	43.40	46.24	49.13	52.08	55.03	58.03	61.08	64.13	67.18	71.38
16.....	11.10	21.68	27.84	34.32	41.08	43.96	46.80	49.69	52.64	55.59	58.59	61.64	64.69	67.74	71.94
16 1/4.....	11.25	22.00	28.24	34.80	41.64	44.52	47.36	50.25	53.20	56.15	59.15	62.20	65.25	68.30	72.50
16 1/2.....	11.40	22.32	28.64	35.28	42.20	45.08	47.92	50.81	53.76	56.71	59.71	62.76	65.81	68.86	73.06
16 3/4.....	11.55	22.64	29.04	35.76	42.76	45.64	48.48	51.37	54.32	57.27	60.27	63.32	66.37	69.42	73.62
17.....	11.70	22.96	29.44	36.24	43.32	46.20	49.04	51.93	54.88	57.83	60.83	63.88	66.93	70.00	74.18
17 1/4.....	11.85	23.28	29.84	36.72	43.88	46.76	49.60	52.49	55.44	58.39	61.39	64.44	67.49	70.54	74.74
17 1/2.....	12.00	23.60	30.24	37.20	44.44	47.32	50.16	53.05	56.00	58.95	61.95	65.00	68.05	71.10	75.30
17 3/4.....	12.15	23.92	30.64	37.68	44.96	47.88	50.72	53.61	56.56	59.51	62.51	65.56	68.61	71.66	75.86
18.....	12.30	24.24	31.04	38.16	45.52	48.44	51.28	54.17	57.12	60.07	63.07	66.12	69.17	72.22	76.42
18 1/4.....	12.45	24.56	31.44	38.64	46.08	49.00	51.84	54.73	57.68	60.63	63.63	66.68	69.73	72.78	77.00
18 1/2.....	12.60	24.88	31.84	39.12	46.64	49.56	52.40	55.29	58.24	61.19	64.19	67.24	70.29	73.34	77.60
18 3/4.....	12.75	25.20	32.24	39.60	47.20	50.12	52.96	55.85	58.80	61.75	64.75	67.80	70.85	73.90	78.20
19.....	12.90	25.52	32.64	40.08	47.76	50.68	53.52	56.41	59.36	62.31	65.31	68.36	71.41	74.46	78.76
19 1/4.....	13.05	25.84	33.04	40.56	48.32	51.24	54.08	56.97	59.92	62.87	65.87	68.92	71.97	75.02	79.30
19 1/2.....	13.20	26.16	33.44	41.04	48.88	51.80	54.64	57.53	60.48	63.43	66.43	69.48	72.53	75.58	79.8

In reality the commercial pipe standards are somewhat larger than the actual diameter, but this is not taken into consideration in the tables, as the ends of pipes are seldom carefully reamed; the general practice being to cut them with a wheel-cutter, which gives them some contraction. So, for this reason, the nominal size of the pipe is taken as d^2 , therefore the tables are for nominal dimensions of fairly clean standard pipe and not for actual sizes, which are a little larger in all cases, except for $2\frac{1}{2}$ and 8 inch pipe, which happen to be a little under the nominal size; if they are made of standard thickness.

When the end, therefore, of a pipe as it leaves a boiler is square and parallel and no regard paid to a proper form of point of easy entry, then eight-tenths only of the Table No. I. is to be taken as the number of U. S. gallons that will pass through a short fairly smooth nipple, the power to move the remainder being consumed in entry; in other words, instead of getting ten gallons through a short inch pipe or nipple in a minute of time, with a 3-inch head of water as per Table No. I., only eight gallons would be found to pass as given in Table No. II., and so on through the whole table; the remainder that might be expected to flow under such head being consumed in the effort of getting the particles of water into the pipe, overcoming the eddies and giving them direction.

If we divide the heads in Table No. II. into that which is consumed by entry and into that which remains to move the water, it will give us about three-tenths of the total head for entry and seven-tenths for the movement of the water. These amounts remain constants for the quantities of water given and for the size pipes given, no matter how much greater the head at our disposal may be. To make this plainer we may say that so long as only thirty-two gallons of water enters a 3-inch pipe in a minute, regardless of what the total head may be capable of producing, three-tenths about of the 3-inch head in the table (No. II.) is the amount that is consumed by entry.

(TO BE CONTINUED.)

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

BLESSING'S WATER-FILTER AND PURIFIER.

THIS device for filtering consists of three iron cylinders, equal in size, two containing sand and one animal charcoal, which are in diameter from four inches upward to any size desired, being proportioned to amount of water to be filtered, and in capacity from half a gallon to 200 or more gallons per minute. In the smallest sand cylinders made the minimum depth of fine sharp sand is thirty inches, and a greater depth in the cylinders of larger size.

Within the sand cylinders are radial arms mounted on a vertical shaft which can be rotated by a hand-wheel or lever fastened to its upper end for the purpose of agitating the sand during the process of cleansing. The three cylinders rest on base-pieces, in which are chambers that have pipe-connections. The bonnets on upper ends of cylinders being firmly bolted will be strong enough to resist any ordinary pressure, and are connected by means of a short pipe, having in it a rolling valve contained in an outer shell, having four parts or openings, one to admit water to be filtered, two to admit water into the sand cylinders, and one through which impure water is exhausted when sand is washed. A hand-lever is provided for the valve for the purpose of moving it, with a quadrant on one of its ends, and a pointer attached to the valve-case, which indicates the different positions of the valve during the process of filtering and cleansing of the filter.

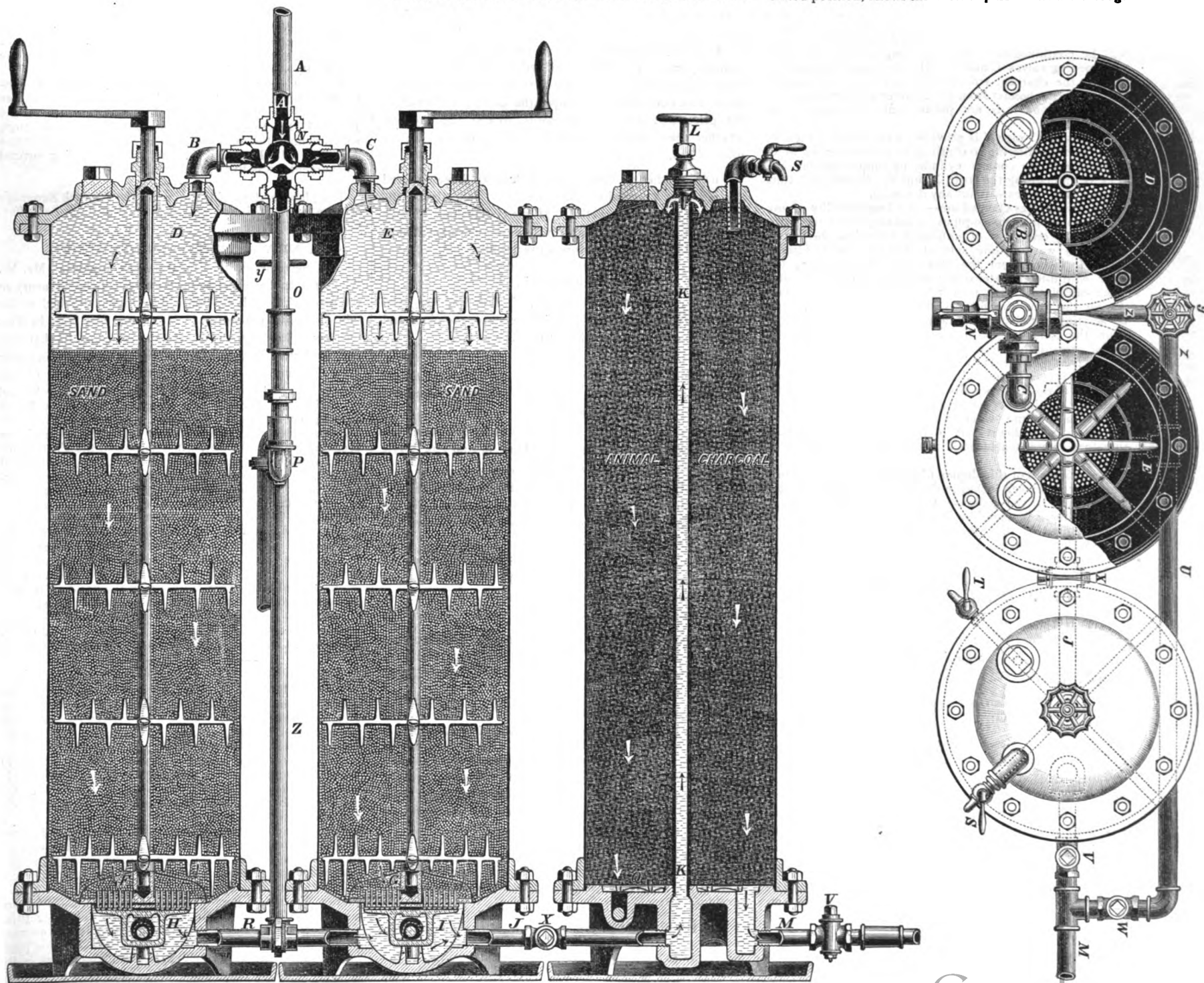
The animal charcoal is placed in the third cylinder, through which all filtered water must pass before it is ready for use. The cylinder containing the animal charcoal is not provided with radial arms for stirring, as the water is thoroughly strained by passing through the two sharp-sand cylinders. The third cylinder is merely to bring the filtered water in contact with the animal charcoal as a purifier. Air-cocks are provided on the top and bottom of this cylinder to aerate the charcoal when required.

To prevent the sand from escaping from the sand cylinder into the lower chambers, and thence into the system of house-pipes, an important feature is introduced which consists of a plate with a number of holes drilled in it, in which are inserted pins or plungers, about the one-hundredth part of an inch less in diameter than the holes, leaving a space for matter to ooze around each pin or plunger. To prevent these small openings from becoming clogged when in constant use, the pins or plungers are fastened to a plate having a yoke cast on it, into which an eccentric is rotated by a small hand-lever, which extends to the outside of the chambers; this rotation moves the pins up and down through the holes, scraping off any dirt or foreign ingredients that may have gathered there. This device is called a sand-valve.

Figure 1 is the vertical section of the filter with a capacity of five or six gallons per minute, the cylinders being twelve inches internal diameter and forty-two inches long.

Figure 2 is a top view showing a part in horizontal section.

The water to be filtered first enters the valve-casing through the pipe A, and thence through the passages in the casing and pipes B and C into cylinders D and E containing the sand, and thence passing downward through the sand and the sand-valves F and G into chambers H and I, and through the pipe R, J, and K, up into the top of the contact cylinder containing the animal charcoal. The valve L on the top of the pipe K, being kept in a raised position, allows the water to pass downward through



the animal charcoal. The screen Q, placed at the bottom of the cylinder, prevents the escape of the charcoal when the water is passing out into pipe M for house supply. All water is received through pipe A and discharged, filtered and purified, into the pipe M. It will be necessary after running some time to cleanse the sand filter. The valve N is then moved either to the right or left by means of a hand-lever, which will place one or the other of the pipes B or C in communication with the pipe O which connects with the sewer, and will, therefore, carry off all impurities from the sand cylinder during the process of washing. This pipe before entering the sewer has inserted in it an ordinary ball-trap P, with a glass cup, which exhibits the condition of the water coming from the filter during the operation of cleansing, and admits of determining the moment when the filter is sufficiently cleansed.

If the valve N is moved so that the cylinder D and the pipes B and O are in communication, the water will then enter as usual through the pipes A and C into cylinder E, and down through the sand-valve G into the lower chamber I, and through the pipe R into chamber H of cylinder D, and up through the sand-valve F and sand in cylinder D and pipes B and O on its course to the sewer. After the water has been running for a few minutes the sand will become loosened in the cylinder D and the shaft with radial arms attached can then be readily turned by the lever shown on top of same, whose movements thoroughly stir up the sand and remove any adhering particles of dirt which will be carried out with the cleansing water. When the sand in cylinder D has become thoroughly cleansed by reversing the valve N which brings the cylinder E, pipes C and O in communication, the sand in the cylinder E will also be cleansed.

After these operations are accomplished and the valve N returned to its central or working position, filtering through both cylinders will take place.

When necessary to aerate the charcoal the valve L can be screwed down in the top of the pipe K, closing the same and closing cock V, and open air-cock S, and drip-cock T, when the water will run out of the contact cylinder, and air drawn in through the cock S to take its place. When the charcoal has become aerated the filtering process will be continued as before by closing the cocks S and T and opening valves L and V. If it be found necessary to remove the charcoal from its cylinder it can be done by removing the bonnet from the cylinder and scooping the charcoal out, as it is not packed, but lies loosely in the cylinder.

A "by-pass" pipe V is provided, having in it a cock W which permits filtering to continue in the sand-filter independently of the contact cylinder by simply opening the cock W and closing the cocks X and V. Filtration is thus secured at all times without any detention.

The advantages claimed are—viz.: Impossibility of any silt escaping into house-pipes; cleansing the filter without getting one drop of unfiltered water into the house-pipes; of washing one side of the filter with filtered water furnished from the other side, thus washing the filter with filtered water only; a contact cylinder of sufficient capacity to give from four to five minutes contact during the time the filter is working at its full capacity; of aerating the charcoal at any time without removing it from the cylinder; of no appreciable diminution from initial pressure of the water entering the filter, though it passes through seventy-two inches of fine sharp sand and forty-two inches of animal charcoal; that the duplex construction of the filter permits it to be cleansed (in less time than one of single construction) with filtered water only; permits no impure water to be brought in contact with the sand in the lower part of the sand cylinders, which therefore remains absolutely free from earthy matter or other debris.

The cylinders of this duplex filter are usually furnished from four to sixteen inches in diameter, having a capacity of one-half to ten gallons of water per minute.

This filter is patented by Mr. James H. Blessing, and is manufactured by the Albany Steam-Trap Co., No. 78 and 80 Church Street, Albany, N. Y.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
July 16.....	26.34	21.02	22.25	29.63	27.60	22.92	28.28

E. G. LOVE, Ph.D., *Gas Examiner.*

The twenty-fourth annual meeting of the Gas Institute was held in Glasgow on June 28, 29, and 30, under the presidency of Mr. W. Foulis, Engineer to the Glasgow Gas Trust. Besides the president's address, the papers read were as follows: "Some Notes on the Distillation of Shale for Oil Making, and the Manufacture of Sulphate of Ammonia," by Mr. D. R. Steuart; "The Management of Workmen," etc., by Mr. R. Fish; "Gas from Oil," by Mr. Stevenson Macadam; "Coke," by Mr. C. Caudon; "Gas Coke as a General Fuel," by Mr. C. E. Jones; "A

New Process for the Distillation and Concentration of Chemical Liquids, especially adapted to the Manufacture of Sulphate of Ammonia: Inventor, the late Alexander Angus Croll," by Mr. Anderson; "Gas Legislation," by Mr. W. J. Warner; "The Sliding Scale," by Mr. George Livesey; "The Guide Framing of Gas-holders," by Mr. H. Y. Webber; and "Specific Gravity Apparatus," by Mr. F. Lux. Mr. C. Gaudon, of Sydenham, was elected President for the coming year, and the next meeting will be held in London.

WE have received the volume of proceedings of the American Gas-Light Association for the meeting held at Cincinnati in 1885, and that at Philadelphia in 1886. It is a neat volume of some 360 pages, published by the association presumably under the direction of its secretary, Mr. C. J. R. Humphreys. It embraces the addresses, papers, and discussions which form the proceedings of the association for the past two years, and will be found of value by all interested in the gas industry.

A RECENT report of the German-Edison Company shows that up to the end of 1886 the company had erected 260 installations, representing 1,000 arc lamps and 70,000 incandescent lamps. The company sold 90,000 incandescent lamps in 1886.

ACCORDING to the *Journal für Gasbeleuchtung* the Municipal Council of Dresden are very well satisfied with the results obtained in lighting the Municipal Buildings with incandescent lamps. The dynamo used was a Siemens-Halske, and the lamps the Edison 16-candle power and the Siemens 25-candle power.

In February last the Common Council of Cleveland passed an ordinance reducing the price of gas from \$1.40 to \$1 per thousand feet. About the same time the gas company made a voluntary reduction to \$1.25, but since that has paid no further attention to the ordinance. Legal steps have been taken to compel the company to reduce the price to \$1, or, in other words, to test the question whether the Common Council have the power to fix the price of gas.

THE Chamber of Commerce of Denver have received the report of a committee appointed to "investigate the subject of oil and gas-wells." If the conclusions of this committee prove true, Denver will have a permanent supply of both oil and gas before a great while.

PERSONAL.

MR. W. L. ANDERSON, C. E., of Trenton, has been selected by the Common Council to prepare the plans and superintend the construction of the new sewers.

MESSRS. ALPHONSE FTELEY and W. H. Worthen, M. Am. Soc. C. E., of New York City, have been appointed by the city of Newark, N. J., to examine and report upon the new sewerage works.

AUGUSTUS LAVER, of San Francisco, has been appointed architect of the new City Hall in that city. His plans indicate a cost of about \$3,000,000.

MAJOR W. H. HEUER, Corps of Engineers, U. S. A., has just made a report to the Chief of Engineers on the jetties at the South Pass on the Mississippi River. He speaks of them as a success.

MAYOR HEWITT, of New York City, has accepted the resignation of Commissioner John D. Crimmins, of the Department of Public Works, in a letter complimentary to the Commissioner.

MR. HOWARD MURPHY, C. E., of Philadelphia, has been chosen a member of the State Board of Health of Pennsylvania, in place of Mr. Rudolph Hering, now of Chicago, who resigned.

DR. DAVID ENGLEMAN, of Easton, has been elected President of the Pennsylvania State Board of Health.

MR. R. C. GRAVES, of Memphis, Tenn., offers to furnish from his artesian-well plant water, free of charge, for public baths, if the city will build the bath-house in a designated locality. Water both hot and cold will be furnished.

THE American Association for the Advancement of Science will meet at Columbia College, in New York City, August 10. Professor S. P. Langley, of Washington, will preside.

THE Police Board of Jersey City asks the medical staff to have an analysis made of the Passaic River water to ascertain the truth about the charges made against its fitness for drinking.

CONVENTION OF AMERICAN SOCIETY OF CIVIL ENGINEERS.

CHICAGO, MILWAUKEE AND ST. PAUL RAILWAY,
CHIEF ENGINEER'S OFFICE,
MILWAUKEE, July 19, 1887.

SIR: In your issue of the 9th inst., giving the discussion at the late convention of the American Society of Civil Engineers, at Hotel Kaaterskill, your reporter misconceived the impression I wished to convey in the discussion on cements.

He reports that I said that my experiments showed that, as a general thing, neat cement mortars have less ultimate strength than when sand is added to same. The cements under discussion at the time I made my remarks were the Mantius and Fayetteville brands, which, I am informed, are very active or quick to set, and I said that with such we were apt to get anomalous results, tests of which frequently show less strength neat than when mixed with sand. This anomaly I intended to explain as being brought about through the impracticability of having time sufficient for thorough manipulation into test specimens before incipient setting had taken place. It is well known that any addition of sand appears to defer setting, thus affording time to properly manipulate the mass into homogeneous mortar before setting or partial induration occurs. As a general rule, I believe any addition of sand to cement acts as an adulterant, just as water acts towards whiskey, though not to the same extent. With slow-setting cement mortars my experience teaches that as usually manipulated into test specimens any addition of inert substance, like sand, causes deterioration.

Yours truly, D. J. WHITEMORE.

IN the report of the business meeting of the convention in the issue for July 16, page 181, the resolution on technical education is reported as having been presented by Mr. E. P. North, which requires modification.

The first part requesting the Board of Direction to consider the advisability of appointing such a committee was introduced by Mr. Oberlin Smith, and referred to the Board of Direction. The second part of the resolution, which defined the duties of such a committee, was introduced by Mr. E. P. North, and, after receiving several amendments, was finally laid on the table.

The plans and specifications for the Newark Sewerage scheme were exhibited and explained by J. S. Schaeffer, C. E.

A NEW SUPERVISING ARCHITECT.

THE Secretary of the Treasury has appointed Mr. W. A. Freret to be Supervising Architect of the Treasury in the place of Mr. M. E. Bell. The salary attached to the office is \$4,500 per annum. Mr. Freret was born in New Orleans in January, 1833. He was educated in that city and in Baton Rouge. He studied his profession under John Communy, the well-known civil engineer of the South, who had been educated in the Polytechnic School in Paris. Mr. Freret's first appointment was by Major Beauregard to rebuild the State University at Pineville. He continued the practice of his profession until the breaking out of the war, when he joined the Fifth Company, Washington Artillery. He served on the staff of General E. Kirby Smith in the Kentucky campaign, and remained with him as Major of Engineers until the end of the war, after which he turned his attention to sugar-planting. He was appointed State Engineer by Governor Baker, and served until removed by General Sheridan. He has devoted himself entirely to his profession since 1872. He is a son of William Freret, who was Mayor of New Orleans in 1852. Mr. Freret built the University of Alabama and other large buildings in the South. He was recommended by the Louisiana Congressional delegation, Generals W. S. Hancock and E. Kirby Smith, Senators Coke of Texas and Walthall of Mississippi, and G. B. Nicholson, Chief Engineer Cincinnati Southern Railroad.

DEATH OF HENRY HUSSEY.

HENRY HUSSEY, a respected citizen and one of the leading plumbers of Boston, Mass., died on board the North German steamer "Saale" on July 15 on the return passage from Europe, whither he had gone for the purpose of benefiting his health.

Mr. Hussey was born in England about forty-eight years ago, and came to this country when a boy. He was apprenticed to the firm of Duffy & Hartwell. On the dissolution of the firm Mr. Hussey started in a modest way in the plumbing business for himself, and it was not many years until his ability and energy had placed him in the front rank of his calling. His work can be found in some of the leading mercantile buildings and private residences in Boston and vicinity.

Mr. Hussey had resided at South Boston for fifteen years. He took a great interest in yachting, and he was commodore of the South Boston Yacht Club for three years past—a position he only recently resigned on account of continued ill health. The funeral, which took place on the 19th inst., was largely attended by members of the yacht club and business associates.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

THE prizes offered by the Wells Memorial Association for the best plans of cottages were competed for by nineteen architects, who sent in thirty-nine plans. The first prize, \$50, was awarded to T. Edward Sheehan, 172 Washington Street; second prize, \$30, to G. F. Sprague, 5 Regent Square, Roxbury; third prize, \$20, to William B. Ash, 42 Phillips Street, and a gratuity of \$20 also, to George M. Shinn 8 Exchange Place. The cottages are to cost \$1,000, \$1,500, and \$2,000 above the land. The plans will be on exhibition for a week at the Wells Memorial Workingmen's Institute, 987 Washington Street, and it is then proposed to publish the successful plans for the benefit of the club members and the public.—*Boston Post, July 16.*

ALBANY, N. Y.—Architects will be invited to submit plans for the National Guard Armory to be built on Washington and Lark Streets.

SAVANNAH, GEO.—The Jury of Award on the Court-house plans find no design sufficiently meritorious of acceptance. A new competition will be instituted.

BUFFALO, N. Y.—A movement has been started among leading business men of Buffalo, to raise a fund of \$100,000 to be offered as a prize for the best invention for utilizing the water power of Niagara River. The competition will be open to the world. Several prominent citizens have already subscribed \$1,000 each toward the fund.

PROPOSALS.

(Continued from page 204.)

REBUILDING WHARVES.—Proposals will be received, from regular dealers only, until August 4, 1887, for furnishing at the Navy Yard, Boston, No. 4 spikes and bolts, No. 5 yellow pine lumber, No. 6 red oak piles, all for immediate use. Edward May, Paymaster, U. S. N., Boston, Mass.

IRON BRIDGE over Buck Creek, Springfield, O. Until July 27. Address J. S. Shewalter, City Clerk.

IMPROVING Chestnut Avenue, Jersey City, from Newark Avenue to Pennsylvania Railroad. Until August 1. Address the Board of Public Works. Also, same date, improvement of Cambridge Avenue, of Virginia Avenue, sewer in St. Paul's Avenue, sewer in Tonnelle Avenue.

WIRE ROPE.—Sealed proposals will be received at Memphis, Tenn., until August 5, for furnishing the following quantities of wire strands: 18,000 feet of 3/4-inch wire strand; 10,000 feet of 3/4-inch wire strand. The right is reserved to reject any or all bids and to waive defects. Smith S. Leach, Captain of Engineers.

THE Board of Public Works and Affairs of the city of Nashville, Tenn., will receive bids until August 9, for the construction of a masonry reservoir of a capacity of 50,000,000 gallons with the necessary influent, effluent and gate wells, and other incidental work. Specifications and drawings can be seen at the office of the City Engineer. J. A. Jowett, City Engineer, Nashville, Tenn.

SPECIAL CASTINGS, water-pipe (16-inch), lead, gate-valves. Until July 30. Address Thomas H. Higgins, Chairman of Board of Water Commissioners, Altoona, Pa.

TIN ROOF on lower roof of Pension Building, Washington, D. C. Until August 8. Address M. C. Meigs, Superintendent Engineer and Architect.

WOODEN HULL for dredging boat, 84 feet long, 24 feet wide, 6 feet 4 inches deep. Until August 9. Address Major Amos Stickney, U. S. Engineers, Louisville, Ky.

WHARF at Wood's Holl, Mass. Until July 17. Address C. S. Fairchild, Secretary of the Treasury, Washington, D. C.

WILLOW BRUSH (8,000 cords) and poles (2,000 cords). Until August 1. Address Captain Smith S. Leach, U. S. Engineers, Memphis, Tenn.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 202-204.

WATER. SEWERAGE, ETC.

SACRAMENTO, CAL.—Plans for filtering the water-supply should be sent at once to L. L. Lewes, President of the Sacramento City and County Improvement Association. The association is considering the whole question of a better water-supply.

CARLINVILLE, ILL.—The time for receiving bids for the proposed water-works has been extended to August 15. W. H. Behrens, City Clerk.

NEWBURGH, N. Y.—Commissioners Moshier, McCord and McCann, of the Water Board, and Engineers Caldwell and Hampson have been appointed a committee to obtain prices on a 2,000,000 gallon pumping engine.

KEARNEY, N. J., has contracted with Jersey City to receive water-supplies from the latter's mains at \$67 per 1,000,000 gallons. The Township Board of Kearney will receive proposals for water-pipe until August 8. Address Chairman Davy for further information.

COLUMBUS, O.—The Trustees of the Water-Works are investigating the pumping machinery of several cities with a view to the purchase of new engines for Columbus.

LAKE, ILL.—Mr. J. Frank Foster has been appointed by the Water Committee to prepare plans and specifications for increasing the water-supply from 8,000,000 to 16,000,000 gallons daily. This will include new pumping-engines.

OSHKOSH, WIS.—The city is proposing to buy the water-works, which now belong to private capitalists.

LANCASTER, Pa.—City Councils have voted to carry out the plan for water-supply designated by J. J. R. Croes, C. E., of New York City.

MANSFIELD, MASS.—The Mansfield Water Company held a meeting July 6 and organized as follows: President, D. S. Spaulding; Vice-President and Treasurer, J. W. Rogers; Secretary, J. E. White. The directors are the above-named gentlemen and Messrs. P. M. Blake and F. W. Spaulding. The capital stock is \$55,000, of which \$30,000 has been subscribed, and the remainder is bonded.

FORT WORTH, TEXAS.—A new pumping machinery and filtering plant is being discussed.

OAK CLIFF, TEXAS.—The Oak Cliff Water Company has been chartered, and water-works have been commenced.

BELAIR, MD.—Water-works is being discussed.

BESSEMER, ALA.—The Bessemer Land and Improvement Company will build water-works.

MONTGOMERY, ALA.—Mayor and Council are negotiating with George A. Ellis, C. E., of Durham, N. C., for the preparation of plans for a sewerage system.

ALBANY, N. Y.—City Engineer Andrews is preparing the profiles for a \$100,000 sewer.

LEBANON, PA.—A. H. Tyson, C. E., has presented his report on sources of water-supply to council. Taking Quittapahilla Creek as the source, he finds it will cost to pump the water \$7 to \$8 per 1,000,000.

TRENTON, N. J.—The Common Council have passed a resolution directing that William L. Anderson, C. E., of Trenton, be appointed to prepare plans and specifications for the new intercepting sewers and to superintend their construction.

TALLULAH, GEO.—A bill is before the Georgia State Legislature authorizing the town to construct water-works.

PLYMOUTH, MASS.—A town meeting was held July 7 for further consideration of the improvement of the water-works. The town indorsed the proposal of the majority of the Water Commissioners in establishing two systems of supply for the town. One system will bring water from South Pond by gravity. The central portion of the town and the highlands will be supplied by the present pumping service in separate pipes. The pressure on Main Street and the business portion of the town will be reduced from about 60 feet head to 45 feet, while that on the elevated portions will be raised 30 feet above the present pressure of from 15 to 25 feet.

PARIS, KY.—The contract for building water-works here has been given to Mr. Davenport, of Charleston, W. Va. The cost is about \$100,000.

MILLEDGEVILLE, ILL.—Address Samuel Walker in regard to water-works here.

ALLENTOWN, PA.—The contract for a pumping-engine of 3,000,000 gallons capacity in 24 hours has been awarded to the Knowles Steam-Pump Company, of New York and Boston, at \$17,000. We referred to the opening of the bids in our issue of June 25.

GOLDEN, COL.—Water-supply for the State Industrial School is discussed.

RUTHERFORD PARK, N. J.—The council is considering the construction of a drainage system.

FARGO.—A proposition has been made by the Fargo Water and Steam Company looking to a lease of the city's water-works.

MILWAUKEE, WIS.—The Milwaukee Water-Works Construction Company has been incorporated by George S. Bartlett, George P. Miller, and Henry M. Ellis. The capital stock is \$300,000.

SUSANVILLE, CAL.—A water-supply will be obtained by sinking artesian wells.

GREEN ISLAND, N. Y.—The contract for the new system of sewers has been awarded to Van Vranken & McGowan, of Green Island, they being the lowest aggregate bidders, \$34,334.50. The contract calls for over five miles of sewers of brick and pipe. The system provides for surface water and sewerage, which will be carried to the bed of the stream in the Hudson River at the foot of Hamilton, Bleeker, Swan, and Saratoga Streets, and will be what is called the cross town system. It will require to complete the work 30,000 feet of vitrified pipe, 3,000 feet of brick sewers, and 1,000 feet of iron pipe. The village trustees have ordered the issue of bonds to the amount of \$50,000 for the completion of the work. The contractors will begin excavating on Hamilton Street next week and about four hundred men will be given employment. It will take about two years to complete the work.

MANKATO, MINN.—will issue \$20,000 of water bonds and \$10,000 of sewer bonds.

SAN BUENAVENTURA, CAL., has voted \$20,000 for a sewerage system.

MOLINE, ILL., will lay \$5,000 worth of iron water-pipe this season.

MOORESTOWN, N. J., is raising funds to obtain a water-supply.

VAN WERT, O.—The sewerage movement has resulted in the decision to obtain plans for a system.

VICKSBURG, MISS.—[Special].—The Vicksburg Water-Supply Company, which has been attempting for months to obtain water by sinking wells above the city, has abandoned further efforts in this direction, and will take water from the Mississippi River, near the Refuge mills, two miles from the central portion of the city, where their pumping works, settling tanks, and buildings will be located. Mr. C. Delafield, chief engineer of the contractors, will be here in a few days to complete all the arrangements with a view of putting the works in operation at an early day. About ten miles of pipe are laid, nearly all the hydrants are in place, and the foundation for the stand-pipe has been completed. This is to be located on Castle Hill. The water from the river will be pumped into large tanks and allowed to settle before being distributed throughout the city. The complete works will cost a quarter of a million of dollars.

MALDEN, MASS.—Our correspondent writes: "Water-works have been established here since 1870, water being delivered by gravitation from Spot Pond, in Stoneham. The Legislature of 1887 gave the city right to increase its water-supply by taking water from Martin's Pond in Reading. Some experiments have been made and surveys given, but nothing definite determined as yet."

Later.—On July 18 the Board of Aldermen passed an order to issue \$25,000 of water bonds, also an order "that a joint special committee be appointed, consisting of the president of the council and three others, and the aldermen to consider the advisability of procuring water from Martin's pond; also, that the committee be authorized and directed to investigate and report the probable expense of a further test at Eaton's wells in Maplewood; also that the committee consider the feasibility and probable expense of cleansing and deepening Spot pond."

CALIFORNIA WATER COMPANIES.—The Aurantasia Land and Water Company has filed articles of incorporation. The object is to acquire and develop land and water and water rights in San Bernardino County. The directors are J. D. Vocum, J. G. Nichols, W. L. McAllister, James Noel and H. J. Bovee. Capital stock, \$500,000; amount subscribed, \$270,000.

The Lincoln Park Land and Water Company has filed articles of incorporation. The object is to buy and sell land and water and water rights. The principal office will be at Lincoln Park. The directors are J. A. Wood, J. P. Earle, George W. Wilson, D. K. Shrode, and H. A. Barclay. Capital stock, \$12,000; amount subscribed, \$6,000.

Articles of incorporation have been filed by the Los Angeles East Side Water Company. The object is to supply the city with water. The directors are Edward Records, D. E. Miles, T. E. Rowan, G. A. Dobinson, and W. T. Lambie. Capital stock, \$500,000; amount subscribed, \$250,000.

LA GRANGE, GEO.—Water-works are being discussed.

NEWBURGH, N. Y.—The Committee on Sewers has been instructed to report on the building of a new trunk sewer.

NORWALK, O.—Additional water-supply will be obtained by sinking wells and providing pumping plant.

BELFAST, ME., is putting in water-works.

HERINGTON, KAN.—Our correspondent writes: "Different parties are already figuring on water-works. Water will be taken to reservoir from a spring about one-quarter of a mile distant. No definite action has yet been taken."

ALTOONA, PA.—Measures have been taken to complete Kittanning Reservoir, lay a 16-inch iron main from the city to the reservoir, construct a barn on Mill River, and do other work on the water-supply at an estimated total of \$175,000. Of this the new main will cost \$85,000.

ST. CLOUD, MINN.—Sykes & Co. have been awarded the contract for putting in the sewerage system.

ST. PAUL.—Incorporated is the Manitou Island Water Company to maintain a system of water-works on Manitou Island, White Bear Lake. Principal place of business, St. Paul; capital stock, \$10,000; incorporators, Elias F. Drake, C. P. Noyes, Charles S. Rogers, S. M. Cary, Robert B. C. Bement, all of St. Paul.

ST. CLOUD, MINN.—Bids for the purchase of the city water-works have been opened as follows: Hiram Upham, Minneapolis, \$15,000; H. W. Phelps and Edmund T. Sykes, Minneapolis, \$19,000; C. E. Gray, Fergus Falls, \$20,000.

WHITMAN, MASS.—Our correspondent writes: "We have water-works here, but the past year the town has built a well 100 feet long, and will soon try it to see if water enough can be got in this way to supply the town. We now take it from a pond, and the well is built beside the same pond, and will be tried very soon."

COBLESKILL, N. Y.—An exhibition of the water-works was made before the Fire Underwriters July 16. J. N. Borst is Superintendent.

LOS ANGELES, CAL.—The Pasadena Park Tract Land and Water Company was incorporated July 8. The capital stock is \$240,000, all of which is subscribed. The directors are N. G. Yokum, J. B. Young, A. K. Hanna, James R. Boal and Samuel B. Hunt.

EAST SAGINAW, MICH.—A movement exists here for the sale of the water-works to a company of Eastern capitalists. The water debt is \$410,000.

KALAMAZOO, MICH.—Council Committee are taking steps for the building of lateral sewers.

NEW YORK CITY.—The Commissioners of Charities and Correction will soon begin to improve the Central Islip County Farm. Drainage and water-supply will be proceeded with immediately.

PETERSBURG, ILL.—The citizens here voted in favor of introducing water-works.

CLINTON, IA.—Proposals for water-works here will be soon let.

MARBLEHEAD, MASS.—The town has completed its contract with the Marblehead Water Company for a supply of water for the term of one year, with the privilege of five years, free of charge for fire and domestic purposes and sprinkling streets, and also two drinking troughs on the neck. The company agrees to furnish water to the town or its inhabitants for all other purposes at rates not exceeding those charged in its schedule for 1887. The town agrees that the company shall have the right during the continuance of the contract to use the pipes already laid by the town.

BUFFALO, N. Y.—The Board of Water Commissioners have contracted with the Holly Company of Lockport for a new (50,000,000) twenty million gallon engine. The price is \$98,750 including six boilers. The bids were given in our last issue.

TALLAPOOSA, GEO.—Incorporated is the Tallapoosa Water-Works Company, J. M. Watson, R. L. Spencer, Lloyd Thomas, J. H. Plummer and others.

CLINTON, ILL.—Address Mayor O. E. Harris about water-works to be built here.

MANCHESTER, N. H.—A project is on foot to build a reservoir on Wilson Hill and establish a high-pressure service.

WATER-WORKS are contemplated at the following places: Lockport, Ill.; Baxter Springs, Kan., filtering system at Carrollton, Md.; Washburn, Wis.; Stafford, Kan.; Olneyville, Ill.; Louisville, Neb.; Hillsborough, N. H.

COVINGTON, KY.—July 15 the Trustees of the Covington Reservoir awarded to Peter, Scully & Crane of Cincinnati, the contract for building the new Kentucky Reservoir, to be situated five miles above Newport, Ky. Its capacity is to be 10,000,000 gallons. The bid at which Peter, Scully & Crane received the contract was \$316,377. The contract for pipe and special castings was awarded to the Cincinnati and Newport Iron and Pipe Company, and the contract for laying it to McRae & Lally, of Lockport, N. Y. The work is to be begun at once and to be pushed vigorously to completion. The purchase of the land and right of way has been completed, and Covington will have its new water not later than October, 1888.

PASSAIC, N. J.—The citizens have presented a memorial to councils requesting early construction of the sewerage system after plans by Col. George E. Waring, Jr.

WEIR CITY, KAN., wants proposals for sinking a well for water-supply. Address P. B. Perkins, North Springfield, Mo.

ELLENVILLE, N. Y.—It is proposed to bring water from Fantinkill Stream.

GAS, STEAM, BUILDINGS, ETC.

THE City of Ypsilanti, Mich., will have the street lighted by the Jenney Electric System of towers.

BROOKLYN.—The Brooklyn Subway Commission has approved the plans of the Brooklyn Electric Light and Power Company, of which N. L. Cocheu is General Manager, for placing their wires underground in the Eastern District.

NORFOLK, VA.—The bids for lighting the streets with electric lamps have been rejected, and new proposals will be issued at once.

KANSAS CITY, MO.—Incorporated is the Kansas & Missouri Natural Gas Company; J. L. White, of Jamestown, N. Y., O. B. Stein and Charles Mott, of Kansas City, and others, incorporators.

LYONS, KAN.—The Lyons Natural Gas, Oil and Mineral Company has been incorporated; S. F. Woodward, J. H. Barkman, J. A. Kneisley and others, incorporators.

TOLEDO, O.—Organized is the Cygnet Pipe Line Company to pipe natural gas and oil. Charles Ruprecht is Manager.

KANSAS CITY, MO.—The Kansas City Paola Natural Gas Company will lay pipe from the gas wells at Paola to Kansas City. The company is composed of D. Husted, J. B. Nesbit and J. L. White, of New York City. Boring has already commenced.

GRAYTOWN, O.—The Graytown Natural Gas and Oil Company has been incorporated by S. F. Freese, L. A. Harmon, H. A. Berry and others.

SCHENECTADY, N. Y.—The Gas Light Company will make large additions to its plant.

TOPEKA, KAN.—The Brush Electric Light Company offers to the city to erect seven towers, 150 feet high, on each tower eight Brush arc lights, for \$9,000 yearly for five years.

SHARPSBURG, PA.—Incorporated is the Sharpsburg Electric Light Company; J. G. Nertz.

WEBSTER, MASS.—The Webster Electric Company has been incorporated; N. T. Hurlbut, Waldo Johnson and others.

BELLEVILLE, KAN.—A new incorporation is the Belleville Electric Light Company; Chauncy Perry, S. C. Crummer, G. N. Stevenson.

EAST ST. LOUIS, ILL.—The National Oil Trust Company is incorporated at East St. Louis, capital stock, \$10,000,000 for the purpose of developing petroleum and gas in Illinois and in the Indian Territory; incorporators, William A. Adams, H. T. Flannigan, and E. H. Smith. The Turner and Bogue and Provision Company, at Chicago; capital stock, \$350,000; incorporators, James Turner, C. B. Hogue, and Leo Stein.

MACON, GEO.—The Macon Gas-Light Company will put in machinery to manufacture water-gas and will build a new holder of 100,000 cubic feet capacity.

OWENSBOROUGH, KY.—The gas-works will be enlarged and new pipe laid. Address H. D. Fitch.

ROCHESTER, Wis.—The Rochester Electric-Light and Power Company has been incorporated, with a capital stock of \$30,000. The incorporators are: C. W. Streeter, and W. Walter, Rochester; Theodore Woodbury, Portland, Me.; Henry C. Hodgkins, John V. Clarke, and John F. Moffett, Watertown, N. Y. The company proposes to supply the city with electricity for light and power.

ST. PAUL.—It has been decided to locate the Soldiers' Home provided for by the late Legislature at Minnehaha Falls. There will probably be an extensive park system surrounding it.

OAKLAND, CAL.—Council Committee has recommended making a contract with the Oakland Gas-Light and Heat Co. to light the streets.

FLUSHING, L. I.—The franchise for lighting the streets will be sold August 1. The company obtaining the franchise will be required to finish work in six months. John M. Wilson, President of the Village Board, should be addressed.

HUNTSVILLE, ALA.—Two companies have received right of way for electric lights—viz.: The Huntsville Electric Light Company, Charles Halsey, President, and the Huntsville Light Company, Robert E. Cox, President.

RAILROADS, BRIDGES, CANALS.

OAKLAND, CAL.—The California Bridge Company will have works built at North Oakland for the manufacture of steel and iron bridges. The Judson Iron-Works are the constructors.

CHICAGO.—The ordinance providing for constructing a viaduct for the Chicago, Rock Island, and Pacific Railroad has passed City Council. Plans also have been prepared for a viaduct for the Chicago and Western Indiana Railroad.

ELIZABETH, N. J.—Incorporated is the Union Street Railway Company.

ROCHESTER, N. Y.—The Rome, Watertown, and Ogdensburg Railroad is constructing a bridge over the Genesee River, at a cost of \$100,000, including approaches. The Phoenix Bridge and Iron Company are contractors for the iron-work, and Professor Rickett, of Rensselaer Polytechnic Institute, is Supervising Engineer.

NEW HAVEN, CONN.—The city has closed the sale of its interest in the New Haven and Derby Railroad to W. H. Starbuck, of New York City, for \$275,000.

LOS ANGELES, CAL.—The Los Angeles Cable Railway Company filed articles of incorporation July 8 to build street railways. Directors: I. W. Hellman, C. Forman, S. C. Hubbel, S. P. Jewett, J. F. Crook.

NEW YORK CITY.—The Rapid Transit Commissioners will advertise for plans.

JAMESTOWN, N. Y.—State Engineer E. Sweet and others have examined the Chautauqua Lake outlet with a view to improving its navigation, and will advertise for proposals.

FARGO, DAK.—14,000 square yards of street paving will be done this season.

RAILROAD.—Articles of incorporation were filed with the Secretary of State last week by the Cherokee and Dakota Railroad Company of Dubuque, Iowa, with a capital stock of \$4,000,000. The incorporators are Messrs. Edward T. Jeffery and John C. Welling of Chicago; William J. Knight, M. Gilles, F. W. Quinby, J. Jacobs and William R. Polmeyer.

OMAHA, NEB.—The new bridge will be both a wagon and a railway bridge. F. D. Moore is engineer to the bridge company.

KNOXVILLE, TENN.—On August 1 there will be a city election on the question of voting \$500,000 in city bonds for the Knoxville Southern Railroad and the Powell's Valley Railroad.

RAILROAD.—The Chateaugay, N. Y., Railroad Company, to construct a railroad from near Lyon Mountain, at the westerly terminus of the Chateaugay Railway in Dannemora, and running by the most feasible route through Clinton County and into Franklin County, terminating at or near Saranac Lake village—distance, forty miles, was incorporated July 15. The managers are Smith M. Weed, Andrew Williams, Alvin L. Duman, Willard F. Parkhurst, Milton L. French, William E. Smith, Peter S. Palmer, Roswell A. Weed, and Henry Paris, of Plattsburg; Robert M. Olyphant and Le Grand B. Cannon, of New York; James A. Burden, of Troy, and Edward Hall, of Lyon Mountain.

INDIANAPOLIS, IND.—The Indiana and Lake Michigan Railway Company has been incorporated with \$300,000 capital stock. A road will be built from South Bend in a north-westerly direction to Buchanan, county of Berrien, Michigan. John Schilling, Charles A. Clark, A. S. Dyckman, Jacob Woolveston, William A. Kier, and William G. George are the directors.

OTTAWA, CAN.—It is understood that the contract for the construction of the second section of the Cape Breton Railway, from Grand Narrows to North Sydney, a distance of eighty miles, has been awarded to Mr. James Isbester, contractor, of Ottawa. The contract price is something over half a million dollars.

BETHLEHEM, PA.—On July 14 the Bethlehem Street Railway was chartered to build a road; capital, \$30,000. Hon. Charles Broadhead, R. L. Cope, J. B. Kemerer are among the incorporators.

DES MOINES, IOWA.—The Southside Viaduct Company has been incorporated. The directors are: C. L. Wartous, President; E. N. Curl, Vice-President; J. A. Jackson, Secretary; W. E. Hazen, Treasurer, and Adam Howell, Thomas S. Wright, J. R. Bancroft, C. E. Riser and C. O. Norse. The purpose of the company is to build one or more viaducts in the city of Des Moines.

BRIDGE.—Incorporated is the Burlington and Illinois Bridge Company, of Burlington, Iowa. A wagon bridge will be built across the Mississippi.

ANNISTON, ALA.—The Anniston Land Company will build a street railroad. John M. McKelroy is President.

RAILROADS.—The Denver, Russell Springs and Southeastern Railway Co., of McPherson, Kan., has been incorporated; D. M. Richardson, Denver, Col.; James Worden, Frankfort, Kan.; J. E. Hilty, Russell,

Spring; H. L. Whitford, T. C. Sawyer, and B. A. Allison, incorporators.

The Lincoln and Black Hills Railroad Co., of Central City, Neb., has been incorporated; G. W. Holdrege, president, and J. G. Taylor, secretary.

The Tillamook, Ore., Railway and Lumbering Co. has been organized at Portland, and will build a narrow-gauge road from Garibaldi to the Doherty River.

PASADENA, CAL.—An electric railway is projected from Long Beach to Pasadena. It will connect with the Rock Railroad to Wilson's Peak, thus uniting ocean and mountains. Another electric railway, from Los Angeles to Pasadena, following the Arroyo Seco, is projected by the owners of the electric road at Los Angeles. The Glendale Steam Dummy Railroad, beginning at Los Angeles and following the river toward the mountains, will cross the hills and enter Pasadena. A third electric railway, from Los Angeles to Monrovia, through Alhambra, is projected. The ties are on the ground.

RAILROAD.—William W. Gibbs and associates, of Philadelphia, have bought the old Pennsylvania, Stonington and New England Company's charter and road and will develop the same into a carrying route.

MILWAUKEE.—A street railroad will be built on Jefferson Street to the Grand Haven Dock on Erie Street at the foot of Jefferson Street.

EASTON, N. Y.—The Washington County Railroad Company was incorporated July 15, to build a line from Greenwich to North Granville.

HIGHGATE, VT.—The selectmen have been authorized to have a new bridge built over the river at a cost of \$15,000.

LAWRENCE, MASS.—The contract for the iron-work of the Union Street bridge has been awarded to the Boston Bridge Company, at \$39,790.

RAILROAD.—The contract for improving the St. Paul and Duluth road between White Bear Lake and Northem Pacific junctions has been let to Langdon & Co., of Minneapolis. At the recent meeting of the stockholders plans were adopted for raising \$2,000,000 for improving the line. The grades will be reduced and many curves straightened. Work will be begun at once and the contract completed by the middle of November. The line between St. Paul and White Bear Lake will be similarly improved this fall and the running time shortened to about twenty minutes, a double track being put in eventually.

DEADWOOD, DAK.—The contract has been let for the extension of the Black Hills branch of the Fremont and Elkhorn to Whitehead, eight miles from this city, bed to be ready for track September 1. Surveyors are at work on the line of extension to Deadwood, but rock work will delay the completion of the road this far until next year.

BIDS OPENED.

BROOKLYN.—H. D. Southard has the contract for pavement about the Hall of Records at \$14,749. Blue-stone will be used.

FORT WAYNE, IA.—The water-works commissioners received bids to furnish a pumping engine from the Holly Manufacturing Co., Gordon & Maxwell, H. R. Worthington, the Dean Steam-Pump Co. and the Noll Steam Pumping Co.

BOSTON, MASS.—Proposals for supplying steam-heating apparatus for the Everett and Cushman schools were opened last week. The bids were as follows:

Everett school—Walworth Manufacturing Company, \$3,714; Albert B. Franklin, \$3,240; Brame, Dow & Co., \$3,484; Ingalls & Kendrick, \$3,500; Walker & Pratt Manufacturing Company, \$3,595.

Cushman school—Walworth Manufacturing Company, \$3,287; A. B. Franklin, \$2,970; Brame, Dow & Co., \$3,276; Ingalls & Kendrick, \$3,345; Walker & Pratt Manufacturing Company, \$3,160.

The contracts were awarded to A. B. Franklin.

DETROIT, MICH.—The Board of Public Works received bids July 16 for furnishing four steam-heating boilers for the City Hall, as follows: James H. Davis & Co., of Chicago, \$5,383; Webster & Meathe, of Detroit, \$4,997.

MILWAUKEE, WIS.—Bids were opened July 11 for stone steps in Juneau Park. Proposals ranged from \$900 for Illinois stone to \$1,869.70 for Berlin granite. No award was made.

MONTREAL, CAN.—At a meeting of the Water Committee July 18 the following tenders were received for the new boiler and 15,000,000 gallon engine for the high-level reservoir: Holly Manufacturing Co., \$21,150; Blake Manufacturing Co., \$20,000; Henry R. Worthington, \$20,000; Gilbert & Son, \$22,500.

TAYLOR'S FALLS, WIS.—Bids for the new school-house were as follows: J. L. Bullard, Minneapolis, \$5,125; D. Triel, Minneapolis, \$4,597.75; Thomas Russell, Prescott, Wis., \$4,950; J. H. Miller, Minneapolis, \$4,200. The contract was awarded to J. H. Miller.

NEW YORK CITY.—One bid was received at the Department of Docks on July 21, for granite work and masonry on the boat-landing wall and about the approach to Pier A, North River. The bid was from Joseph Moore, whose figure was \$9,100 and, as it was considered too high, the work will be re-advertised for August 5.

GOVERNMENT WORK.

SYNOPSIS of bids for iron-work, wood flooring, glass, hardware, painting, and polishing for Court-House, etc., Lynchburg, Va., opened July 15 by Supervising Architect of the Treasury Department: John O'Connor, Buffalo, N. Y., \$25,800; Cudell & Lehman, Chicago, Ill., \$22,212; John Mitchell, Louisville, Ky., \$21,272; Harris & Co., Newport, Ky., \$25,584; The Robert Mitchell Furniture Co., Cincinnati, O., \$21,757.

SYNOPSIS of bids for materials and all carpenter-work required for floors and to enclose building, Court-House, etc., New Albany, Ind., opened July 15 by the Supervising Architect of the Treasury Department: John O'Connor, Buffalo, \$14,700; Harris & Co., Newport, Ky., \$5,200; Thomas Brockman, Fremont, O., \$8,931; Cudell & Lehman, Chicago, \$5,226; John Mitchell, Louisville, \$4,790.

WASHINGTON, D. C.—Abstract of proposals opened July 20 by Colonel J. M. Wilson, U. S. A., for laying about 750 square yards of asphalt pavement in Judiciary Square and Washington Circle: H. L. Crawford, \$1.35 per square yard. Contract awarded to them.

NEW YORK CITY.—Bids were opened at the Army Building, on July 20, by Walter McFarland, Lieut.-Col. of Engineers, for building a dyke at Saugerties Harbor, N. Y. The engineer's estimate called for 2,300 feet of dyke. The following were the bidders: Joseph L. Powley, Rondout, N. Y., \$7.93 per lin. foot, total \$18,230; Alexander Sturgeon, Kingston, N. Y., \$8.85 per lin. foot, total \$20,335; John Satterlee, Englewood, N. J., \$8.20 per lin. foot, total \$18,800; Stephen A. Kelly, Brooklyn, N. Y., \$9.65 per lin. foot, total \$22,195; Ross & Sanford, Jersey City, N. J., \$10.40 per lin. foot, total \$23,920; Henry Dubois & Sons, \$6.79 per lin. foot, total \$15,617.

SYNOPSIS of bids for iron and slate work for stairs of Court-House, etc., Erie, Pa., opened July 15 by the Supervising Architect of the Treasury Department: Manly & Cooper Manufacturing Company, Philadelphia, Pa., \$8,487; Marshall Foundry and Construction Company, Pittsburgh, Pa., \$12,726.97; Haugh, Ketcham & Co. Iron Works, Indianapolis, Ind., \$7,066; Champion Iron Fence Company, Kenton, O., \$6,083.40.

SYNOPSIS of bids for furring and lathing for Court-House and Post-Office at Waco, Tex., opened July 13, 1887, by the Supervising Architect of the Treasury Department: Enterprise Wire-Cloth Manufacturing Company, \$1,663.33; Clinton Wire-Cloth Company, \$2,276.92.

SYNOPSIS of bids for iron stairs for Money Order Department of Court-House and Post-Office Building, Columbus, O., opened July 18, 1887, by the Supervising Architect of the Treasury Department: Champion Iron Fence Company, \$421.44.

WASHINGTON, D. C.—The opening of proposals for cast-steel guns has been postponed by Secretary Whitney of the Navy, until September 20.

NEW YORK CITY.—Bids were opened at the Army Building, by Deputy Quartermaster-General Henry C. Hodges, on July 18, for furnishing 100 cubic yards of 3/4-inch broken trap rock, and 200 cubic yards of trap-rock screenings. The following were the bidders: C. A. Brown, 3/4-inch trap-rock, per cubic yard, \$2.10; screenings, per cubic yard, \$2.10. Thomas Hayden, trap-rock, \$2.15; screenings, \$2.15. John H. O'Rourke, rock, \$2.40; screenings, \$2.40. George Cranfor, rock, \$2.40; screenings, \$2.40. Palisade Stone Company, rock, \$1.90; screenings, \$1.90. Alex. J. Howell, rock, \$2.14 1/2 (North River granite, \$2.04 1/2); screenings, \$2.14 1/2 (granite screenings, \$2.04 1/2). Calvin Tomkins, rock, \$2.15 (Tomkins Cove blue stone, \$1.90); screenings, \$1.90 (Tomkins Cove blue stone screenings, \$1.90).

The prices were for cargo lots of about 375 cubic yards. The contract was awarded to the Palisade Stone Co., who were the lowest bidders.

NEW YORK CITY.—Bids were opened at the Army Building, on July 20, by Walter McFarland, Lieut.-Colonel of Engineers, U. S. A., for deepening the channel in Raritan Bay, New Jersey. The engineer's estimate calls for 150,000 cubic yards of dredging. The following were the bidders:

Morris & Cummings Dredging Company, 24 1/2 c. per cubic yard; total, \$36,750. American Dredging Company, 26 c. per cubic yard; total, \$39,000. Thomas Potter, 26 c. per cubic yard; total, \$39,000. Atlantic Dredging Company, 23 1/2 c. per cubic yard; total, \$35,250. P. Sanford Ross, 24 1/2 c. per cubic yard; total, \$36,750.

ABSTRACT of proposals, opened July 19, 1887, at U. S. Engineer's office, Burlington, Vt., for construction of breakwater at Gordon's landing, Lake Champlain, Vt. by Major M. B. Adams, Corps of Engineers:

Nelson W. Fisk, Isle La Motte, Vt., 7,100 cubic yards of rubble stone, furnished and delivered on the work, 83 c. per cubic yard, total \$5,942.80; 3,957 cubic yards of large stone, furnished and delivered on the work, \$2.68 per cubic yard, total \$10,604.76; 184 linear feet of timber, furnished and delivered on the work, 70 c. per foot, total \$128.80; 258 pounds of bolts, spikes and iron, furnished and delivered on the work, 7 c. per pound, total \$18.06; grand total, \$16,834.42.

Mark S. Leavy & John C. Buckley, Albany, N. Y., 8 1/2 c. per cubic yard, total \$5,907; 24 lb. per cubic yard, total \$813.36; 98 c. per linear foot, total \$376.32; 9 c. per pound, total \$23.22; grand total, \$16,119.90.

Stephen V. R. Hendrick, Richville, N. Y., \$2.50 per cubic yard, total \$17,900; 83 c. per cubic yard, total \$13,849.50; 40 c. per linear foot for 280 ft. round timber and 50 c. per linear ft. for 104 ft. of piles, total \$164; 4 c. per pound for drift bolts and spikes, 55 pounds at 6 c. per pound for 203 pounds strap iron and screw and washer bolts, total \$14.38; grand total, \$31,927.88.

John L. Johnson, Fulton, N. Y., 90 c. per cubic yard, total \$6,444; \$2.39 per cubic yard, total \$9,472.23; 60 c. per linear foot, total \$230.40; 5 c. per pound, total \$12.40; grand total, \$16,144.53.

William J. Daly, Ogdensburg, N. Y., 84 c. per cubic yard, total \$6,078.84; \$2.24 per cubic yard, total \$8,863.68; 50 c. per linear foot, total \$192; 6 c. per pound, total \$5.48; grand total, \$15,150.

BURLINGTON, VT.—The following bids for extension of breakwater at Burlington, Vermont, were received by Major M. B. Adams, Corps of Engineers, U. S. A.: James B. Donnelly, Oswego, N. Y., 108,000 ft. b. m., of hemlock timber, delivered, \$23 per m., total \$3,554.14; 82,500 feet b. m., white pine timber, delivered, \$30 per m., total, \$2,475.18; 300 feet b. m. white oak timber, delivered, \$50 per m., total, \$15,000; 26,160 pounds of drift bolts, delivered, 5 cents per pound, total, \$1,308; 768 pounds of screws and washer bolts, delivered, 6 cents per pound, total, \$46.08; 10,128 cubic yards of stone, delivered, 95 cents per cubic yard, total, \$9,621.60; grand total, \$18,023.

John L. Johnson, Fulton, N. Y., \$24 per m. ft., b. m., \$4,752.14; \$33 per m. ft., b. m., \$2,722.70; \$40 per m. ft., b. m., \$14,400; 4 cents per pound, \$1,046.40; 10 cents per pound, \$6,800; 90 cents per cubic yard, \$9,115.20; grand total, \$17,727.64.

Luther Whitney, Keeseville, N. Y., \$24 per m. ft., b. m., \$4,752.14; \$30 per m. ft., b. m., \$2,475.18; \$80 per m. ft., b. m., \$28,800; 4 cents per pound, \$1,046.40; 12 1/2 cents per pound, \$96; 75 cents per cubic yard, \$8,001.12; grand total, \$16,390.64.

Mark S. Leavy & John C. Buckley, Albany, N. Y., \$22 per m. ft., b. m., \$4,356.13; \$30 per m. ft., b. m., \$2,475.18; \$48 per m. ft., b. m., \$17.38; 9 cents per pound, \$2,354.40; 8 cents per pound \$61.44; 93 1/2 cents per cubic yard, \$9,486.56; grand total, \$18,750.99.

Stephen V. R. Hendrick, Richville, N. Y., \$24 per m. ft., b. m., \$4,752.14; \$35 per m. ft., b. m., \$2,887.71; \$50 per m. ft., b. m., \$1,812; 4 cents per pound, \$1,046.40; no bids on screws and bolts; 90 cents per cubic yard, \$9,115.20.

Robert Henry Rogers, Plattsburg, N. Y., \$30 per m. ft., b. m., \$5,940.18; \$40 per m. ft., b. m., \$3,700.24; \$45 per m. ft., b. m., \$1,620; 5 cents per pound, \$1,308; 7 1/2 cents per pound, \$57.60; \$1.23 per cubic yard, \$12,457.44; grand total, \$23,079.66.

MISCELLANEOUS.

NEW YORK CITY.—The Union Dredging Company, who have made numerous contracts for dredging between the piers on the North River at thirty cents per square yard, have cancelled their contracts for work at that figure, and will complete such jobs as are now unfinished at twenty cents per square yard.

The statements which have been published in some of the evening papers, to the effect that the above company were to undertake all future work at the uniform rate of twenty cents per square yard, was erroneous, as all new work will be advertised as heretofore.

A GREAT BRIDGE UNDERTAKING.—I saw General Annokoff yesterday, and he told me that he expected to leave for Hokkaido to complete the Samarand branch of the Transcaspian Railway. The immediate supervision of the whole business having been confided to the two Governors-General of the Amur and Eastern Siberia, who are chiefly under the orders of the Minister of War, the latter's authority in the matter is nearly sure to prevail. Certain Americans have already proposed to connect the Siberian line with the American continent by building a bridge across Behring Strait. There is nothing impossible, it seems, to American or Russian engineers.—*St. Petersburg Correspondent of London Times.*

THE City Council of Mexico has revoked the contract with a water-works company for supplying the citizens with water because of alleged violations of the terms of the contract on the part of the company.

NEW HAVEN, CONN.—Tracy Bros. of Waterbury recently submitted a bid for doing the carpenter and mason work on New Haven's new almshouse, which was \$2,700 lower than their competitors. A commission, composed of citizens and the Board of Selectmen, refused to award the contract to Tracy Bros. because they were not residents of New Haven. John W. Ailing, counsel for Tracy Bros., immediately applied for an order enjoining the commission from awarding the contract to any but the lowest bidders. To-day Judge Stoddard granted the injunction. The case has attracted considerable attention throughout this and other States, the action taken in reference to non-resident bidders being a novel one.

MILWAUKEE, WIS.—The Phoenix Garbage Consuming Company, consisting of Dr. F. A. Marden, William Forrestal, and others, has taken the contract to burn the city's garbage for \$10,000 a year for one year, with the privilege of three years if the city finds it proves satisfactory.

FRESNO, CAL., will spend \$50,000 on improvements.

RAILROADS IN CHINA.—Washington, June 30, 1887.—Consul E. J. Smithers, of Tien Tsin, China, has sent to the State Department a copy of a proclamation from the Viceroy of the Province of Chihli relating to the construction of railways in that province. It sets forth the advantages to be derived from railways, and urges intending stockholders not to "hesitate or delay lest they may by so doing lose their opportunity." More than a month ago the directors of a railway company, composed entirely of Chinese officials, issued a prospectus for constructing a railway between Tien Tsin, Kaiping, and Taku, on the seaboard, and invited Chinese capitalists to subscribe to the stock. But owing to a want of confidence in joint stock companies under Chinese management the Chinese gentry and capitalists held entirely aloof from the undertaking. Now that the Government has granted its support, however, the directors have invited tenders for cross-ties and rails, and it is confidently expected that the road will be constructed before the close of the present year. It will be about 100 miles long.—*N. Y. Herald.*

PORTLAND, ORE., will spend \$2,000,000 in city improvements.

MISSISSIPPI RIVER Commission, at a meeting in New York City July 2, allotted \$456,000 for levees.

MINNEAPOLIS.—President Loring has presented to the Park Commission an estimate for improvements on parks and boulevards amounting to \$11,800.

BATTLE CREEK, MICH.—A sanitary survey with a view to improvements is to be made.

SPRINGFIELD, ILL.—Articles of incorporation of the Havana and Quincy Railway Company have been filed. It is proposed to construct this railway from Havana to Quincy, the principal business offices to be established and maintained at Quincy. The incorporators are W. H. Collins and A. W. Wells, of Quincy; A. K. Lowrey, of Mount Sterling; T. Hamer, of Vermont, Ill.; W. B. Larkworthy, of Quincy; I. N. Pearson, of Macomb, and J. M. Darnell, of Rushville.

MANITOU, COL.—The town has voted to have water-works constructed at a cost of \$40,000.

MINNEAPOLIS.—The Park Commission has decided to put down a cement sidewalk around the Ninth Ward Park to cost \$26,000.

TRADE CATALOGUES.

EXETER MACHINE WORKS, Exeter, N. H., have just issued a catalogue entitled, "Steam for Warming." Steam warming practically considered, illustrating and describing the "Exeter steam-heating apparatus." William Burlingame, Agent and Treasurer, 19 Federal Street, Boston, will send copies of the book on request.

We have just received a catalogue of the Mahony Heater, issued by M. Mahony, Troy, N. Y.

THE Herenden Manufacturing Company, of Geneva, N. Y., has sent us their catalogue illustrating the Furman Steam-Heating Boiler.

PUBLICATIONS RECEIVED.

REPORT OF PROCEEDINGS of the Annual Meeting of the American Gas-Light Association held at Cincinnati, O., October 21, 1885, and Annual Meeting held at Philadelphia, Pa., October 20, 1886. Published by the Association, C. J. Russell Humphreys, Secretary, Lawrence, Mass.

TWENTIETH ANNUAL REPORT of the Health Department of the city of Cincinnati for the year ending December 31, 1886. Byron Stanton, M.D., Health Officer.

THIRD ANNUAL REPORT of the Board of Health of Syracuse, N. Y., 1886. John Van Duyn, M.D., Health Officer.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.
NUMBER 9.

PUBLISHED EVERY SATURDAY.

NEW YORK, JULY 30, 1887.

LONDON, AUGUST 13, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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READY-MADE SPECIFICATIONS.

SINCE our reply to "D. M. M." in regard to "Ready-Made Specifications" for heating apparatus we have received several communications from parties who are anxious to furnish them, one gentleman being willing to give the careful experience of twenty-five years abridged into a specification that presumably must be intended to cover all classes of work.

It seems unnecessary for us to explain that these correspondents have misunderstood the intention of our reply to "D. M. M."

A general specification is no specification, and a special specification is applicable only to the particular apparatus and special condition for which it is drawn, and no other.

After about twenty years' experience ourselves in this direction we are forced to declare that we have never been able to make one specification do twice, nor is any qualified professional man satisfied to-day with his specifications written last year. The fact is, if he had to write them over again he would, as a result of experience gained since, be able to improve them, at least, he would change them by modification or enlargement.

We move with the times, and, as progress increases in a ratio somewhat as the square of the times, the specification written now will be much more out of date twelve months hence than; those prepared twelve months ago are out of date now.

A contracting firm which makes a specialty of some particular boiler or apparatus may use a blank specification, and fill it in with the sizes required, etc., for the building they wish to bid on; but a professional man, architect, or engineer, who has any regard for his own or his client's interest, could not present such an instrument to the various bidders.

If he knows what he wants, it is his duty to describe it in the best and plainest manner possible; but when he accepts the stereotyped form of some contracting firm he does an injustice to himself, his client, and the contracting firms whom he asks to make tenders.

Taking the matter of steam-heating for the purpose of illustration, we should say that when an architect or engineer desires bids from several engineering firms he should state the size of the boilers he wants in the simplest language, and what they are to be made of, the size, quality, and location of the radiators, the size of mains, etc. Let him also furnish an ample chimney to his building and then say to the engineering firms he has confidence enough in to invite to bid: "Give me your figure for that work, and say how you usually carry out the details."

If he is young or inexperienced and does not know how to proportion his boiler and heaters or decide between plans submitted, he can consult an engineer who does, and, after once having determined what he wants, let him not fortify his position and throw the responsibility of the warming of the building on the contractor by demanding that if the apparatus he has specified is not ample the contractor must make it good at his own expense, etc., or that the building must be warmed to 70° Fah. when the thermometer is at zero.

General specifications, which say nothing, are the cause of nearly all the failures in steam apparatus.

Competent and careful architects or engineers specify what they want in this respect the same

as they do the minutiae of other building construction, and they would no more copy some other man's specification for a boiler, filling the blank spaces with a thickness or length, than they would some empirical formula they knew nothing about or had not tested for the construction of walls.

Of course, the study of the specifications of known competent architects or engineers will be a great assistance to beginners, and even to experts, and therefore we wish it understood that what we do condemn is the reckless and unadvised use of the whole or part of any specification by a novice.

THE ELECTRIC SUBWAY.

ELSEWHERE in this issue we print a set of rules respecting the stringing of wires overhead, which were adopted at a recent meeting of the Board of Electrical Control in New York City, but have since been referred to an electrical engineer for revision. It is positively stated that permits for this purpose are but temporary, "pending the providing of underground accommodation."

The important provisions are those limiting the lines of poles to but one on each side of each street or avenue for similar electric service. The poles for electric-lights are to be twenty feet high and eight inches in diameter at base at least, and of iron with wood cross-arms. Other poles to be at least sixty feet high. All poles to be at least ten feet from any lamp-post or other pole, and all poles, new and old, to be plainly marked with the initials of the company owning them. No arc, electric-light, or power wires are to be stretched over any portion of any house or building. No new wires to be stretched in streets where conduits are, or are being, provided.

There are also provisions limiting the time that poles may lie upon the ground, requiring permits to be exhibited to every member of the police, or officer or inspector, etc., of the Board of Control, and requiring bonds to be given for certain purposes.

It will be seen that these rules strike at many of the abuses at present existing, and enable those in authority to control this great nuisance and keep it within reasonable limits. The provision prohibiting the stringing of wires for arc-lights over buildings is one which tends greatly to lessen the danger of fire otherwise ensuing.

The statement made by General Averill to the Board of Electrical Control on the strength of some reputed samples of destruction of iron pipe by cement mortar will not bear criticism.

It is a positive and most thoroughly established fact, that our native cements, as a rule, are a protection to iron. This is certainly true of all the Rosendale cements, most, if not all, the Portlands, etc. It is possible that some peculiar cement was used in the case mentioned by General Averill, but it is more likely that there was a dripping of some form of acidulated water, which at last reached the iron and destroyed it. It is not an uncommon thing for iron pipes to be destroyed by the materials surrounding them, and, as we have pointed out in other cases, cement mortar is not so impermeable but that in a length of time the iron would be reached.

The problem of the best system for laying the wires underground is not an easy one, and it will only be solved by patient trial, observation, and study. Meantime the control of the present methods and minimizing the accompanying evils is a move in the right direction.

DETROIT DOCTORS IN COUNCIL.

THE *American Lancet* for July, published in Detroit, contains a discussion by the Detroit Academy of Medicine on the sanitary condition of that city, which will be found amusing reading by sanitary engineers.

The starting point of the debate was a paper by Dr. Samuel P. Duffield, who calculates that Detroit produces 5,479 tons of sewage a month; assumes that if the sewers are not flushed by rain this amount of matter will remain in them, apparently forgetting that the greater part of it will be washed away by the water which conveyed it into the sewers, and declares that traps are useless because "the water of the trap absorbs not only noxious gases, but also germs, and give them

water runs into the sewers except when it rains, also that the house-drains are a source of greater danger than the sewers, and that the city has no provision for the removal of garbage. He said: "We all trust to Providence, and Providence means for us a horde of self-appointed Polack children who carry off what they want—whether it is refuse or not—and deposit the rest in some convenient corner where it may rot in peace."

Dr. Yemans thought that the city has a fine system of sewers. He had explored, with the engineer, one of those most complained of and found it perfectly odorless.

Dr. Connor very wisely remarked that "in this discussion it is evident that we are all somewhat doubtful about existing facts. We argue on probabilities."

And this is the real lesson to be drawn from this discussion. To determine whether Detroit is in bad sanitary condition, and if so to what this is due, requires data which no one who took part in the discussion possessed. The mere gross death-rate of the whole city gives no information on this point beyond pointing out that

ordinary potter. Messrs. Henry Doulton & Co. are to be congratulated upon the possession of such an artist in their works, the more so as they are one of the few firms that appreciate and give recognition of the share their assistants have rendered in making the position that the firm now holds.

In 1883, reference was made in this column to the custom of certain medical journals in connection with notices for advertisers. I refer to this again to emphasize a protest against an existing custom, which is neither beneficial to, nor worthy of, the position of the journals practicing it, nor of productive of special interest to technical readers. The custom I refer to is that of inserting manifold paragraphs. I notice in four journals dealing with engineering and construction this week, a paragraph which is in all, to every purpose, *ipsissima verba*, the only distinction being that in some cases it is abbreviated by the deleting of some of the matter. As with every paragraph of this class the business end is in the tail, where it states that a well-known firm has received orders for goods. It is further a matter for surprise that leading engineering firms should ask and receive the favor of such insertions which are so manifestly only trade puffs.

SAFETY VALVE.



RESIDENCE OF E. N. COOK, BUFFALO, N. Y.—GREEN & WICKS, ARCHITECTS.

up from the wrong side of the trap to hurt our comfort and our health." Every well-educated sanitarian knows that this statement is incorrect, and we are, therefore, not surprised to find Dr. Duffield advising the attempt to ventilate all the sewers by one large shaft heated by a reverberatory furnace, in sublime unconsciousness that this method has been repeatedly tried and found useless.

In the discussion Dr. Andrews says, that of all the cities on the Great Lakes Detroit has the highest mortality (from 21 to 23 per 1,000), and that the cause is probably connected with the sewers, at the same time pointing out the absurdity of Dr. Duffield's ventilating-tower proposition and commenting on the large number of privy-vaults in the city. Dr. Emerson stated that Detroit streets are not cleaned during the winter months, and thought that the rotting wooden pavements were a great cause of disease. Dr. Carstens thought the sewers might be disinfected by steam.

Dr. Lyons did not believe that Detroit has a higher death-rate than other cities, pointed out the fallacy of Dr. Duffield's assumption that no

there is need for investigation. What is needed is definite, precise information as to the mortality rate in different parts of the city and its relations in each section to age and prevailing diseases causing it. With this as a basis a study of the local topography of each district and the character of its population, its drainage and sewerage, etc., can be made practically important, and not otherwise.

OUR BRITISH CORRESPONDENCE.

Artistic Value of a Terra-Cotta Panel—Puffs in Engineering Journals.

LONDON, July 13, 1887.

THE London journals have lately been testifying in high terms to the artistic value of the latest terra-cotta panel executed by Mr. George Tinworth, of Messrs. Doulton's Works, Lambeth. This panel is the largest work in terra-cotta yet executed by Mr. Tinworth, the figures being life-size, and the whole panel measuring 20'x8'9". The subject is, "Christ before Herod." Mr. George Tinworth is not only an artist, but he is also a practical worker, having raised himself by his own ability from the position of an

OUR SPECIAL ILLUSTRATION.

THE subject of our special illustration this week is the Quadrangle of the New University Buildings, Edinburgh, Scotland. R. Rowand Anderson, LL. D., is the architect.

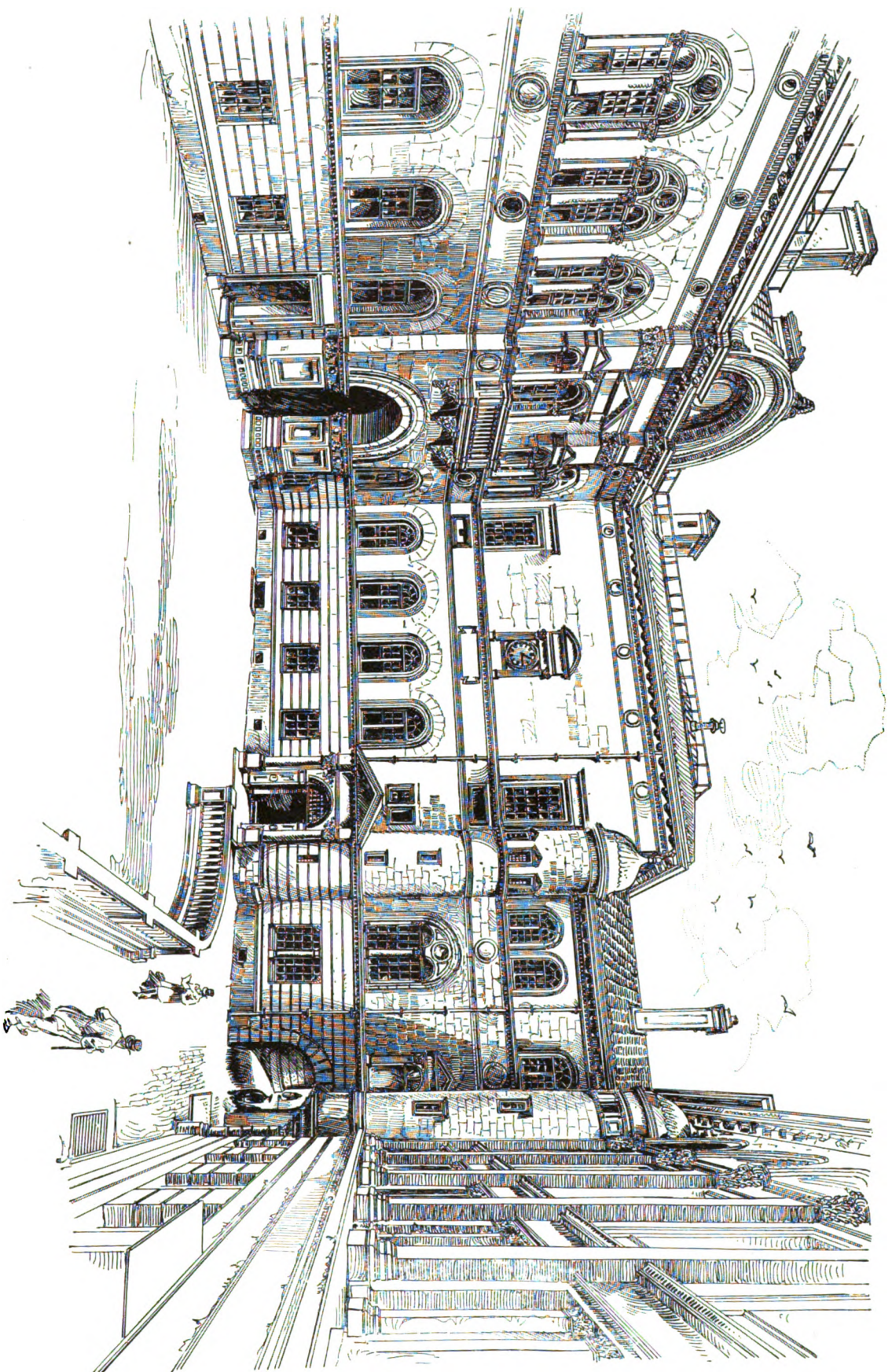
OUR VIGNETTE ILLUSTRATION.

RESIDENCE OF E. N. COOK, BUFFALO, N. Y.—GREEN & WICKS, ARCHITECTS.

THE subject of our vignette illustration this week is the house of Mr. Edward N. Cook, on Delaware Avenue, Buffalo, N. Y. It is of brick and wood, shingled entirely in red-wood shingles. Dining-room and halls in white oak. Library and second-story rooms in red wood. Drawing-room in white pine, painted. Finish in Colonial style. The cost was \$9,000. The architects were Messrs. Green & Wicks, of Buffalo, N. Y.

OUR DETAIL SHEET.

OUR detail sheet this week is a specimen of old Colonial work and shows the garden entrance and *porte cochère* of the residence of G. R. Emmerton, Esq., at Salem, Mass., of which Mr. Arthur Little, of Boston, is the architect. From the door of the platform entrance is had through a small hall to the toilet and coat rooms. The balcony opens from large stair-landing.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

THE QUADRANGLE OF THE NEW UNIVERSITY BUILDINGS, EDINBURGH.

R. ROWAND ANDERSON, LL. D., ARCHITECT.





PAVEMENTS AND STREET RAILROADS.

No. VIII.

(Continued from page 658, Vol. XV.)

AS THE object of these articles is to give the results of experience under all conditions of practice, we shall in the present article quote from the experience at Omaha as detailed by Mr. Rosewater in the report for 1886. As is well known, the temperature ranges here are extreme, and therefore most trying on any material used for a covering.

Until 1883, the material used for both curbing and paving was Nebraska limestone. This disintegrates rapidly under the action of frost, and was also high in price owing to lack of competition.

Colorado sandstone is much better, and the larger part of the curbing now in use is of this material. To prevent a monopoly, however, Mankato limestone and Berea sandstone are admitted, but they are softer and not so durable.

The result of competition has, however, been a reduction in price in the Colorado sandstone of at least 16 per cent.

Up to 1882 but one street had been paved. This had a Telford macadam twelve inches deep of Nebraska limestone. It soon wore into ruts and became covered with mud. In the fall of that year, as the result of an investigation in other cities, "stone and sheet-asphaltum" were recommended for pavements "on all but steep thoroughfares, and upon grades where stone blocks would not afford sufficient footing to use macadam."

The charter provided that street railways were to pay for paving within their lines, the city paid for street intersections, and property owners for pavements opposite their lots. Funds were raised on twenty-year bonds at six per cent. for intersections. The property owners paid in five installments, at respectively sixty days, one, two, three, and four years, the amount being at first paid by "district bonds." Later on the time of payment for property holders was extended to ten annual payments. The majority of the property holders determine on the material to be used.

A bitter controversy was brought about by the acceptance of a bid to lay Sioux Falls stone under proposals calling for granite. The courts finally decided that it was granite. The result has been that Colorado stone has fallen from \$3.49 in 1884 to \$2.60 in 1886, and Sioux Falls stone to \$2.60 as against \$4.35. Competition has reduced all rates except that for asphaltum, so that wood and stone are the most recent favorites.

Two widely different forms of cross-section have been adopted for streets, depending on whether they were provided with storm-water sewers or not. Where these are provided the gutters are shallow, and the centre of the street is about at the level of the curbs.

In other streets a deep, flat, V-shaped gutter is used, and the street centre is one to six inches below the curbs. The diagrams annexed will illustrate the two forms.

As to foundations for pavements the experience seems to classify them in order of merit as follows: (1) concrete, (2) broken stone and sand, and (3) sand. Even in this frigid climate a concrete foundation six inches thick seems to be ample for all purposes. This statement is made with the reservation that the concrete shall be put down under competent inspection. No great difference in result was found from the use of the various sands of the neighborhood.

As to surface material for pavements sheet-asphaltum is given first place for cleanliness, lightness of traction, and non-absorbent qualities. It requires specialists on the other hand for its maintenance, and where wind and moisture collect on flat grades it rapidly disintegrates. For this reason it is not now used in gutters. Along street-car tracks it is absolutely necessary to provide a toothing of stone to prevent formation of ruts. As to resisting a climate ranging from 35° Fah. below zero to 120° Fah. above, four years' experience decides in its favor. As in all forms of block paving cracks are developed by extreme cold, but they close up closely in summer. It does not seem adapted to grades of over five per cent.

Sioux Falls stone is a quartzite, close-grained, non-absorbent, and frost-proof. It does not break as evenly as granite or sandstone, and as it will probably wear slippery it is recommended that the blocks be limited to three inches thickness. It withstands the heaviest traffic.

Colorado sandstone affords a good footing, and seems to withstand the elements well, but its durability under wear has not been fully tested. Wood can be recommended for its cheapness; compared with the other materials for durability it is not so good.

As to maintenance of paving, the usual difficulties of a constant breaking and opening of streets for all sorts of purposes have been experienced. It is recommended that a price be fixed by ordinance for each such opening, and that before the permit shall issue a deposit be made of funds sufficient to cover the price of restoring and keeping the street surface in repair. This price to be fixed by a contract to be made with some responsible man who shall do all such work.

(TO BE CONTINUED)

A GRAND PIANOFORTE.

THE *Building News*, London, thus describes a pianoforte designed by Mr. L. Alma-Tadema, R. A., for Mr. H. G. Marquand, of New York City:

At the rooms of Messrs. Johnstone, Norman & Co., 67 New Bond Street, W., a very beautiful and artistic pianoforte is to be seen for a few days, when it will be despatched to its owner, Mr. Marquand, of New York. The case of this costly pianoforte has been designed by Mr. L. Alma-Tadema, R. A., and contains a beautiful painting, by Mr. E. J. Poynter, R. A. About three years ago Mr. Alma-Tadema recommended to Mr. Marquand, a gentleman of large fortune and of cultivated taste, the firm of Messrs. Johnstone, Norman & Co., to undertake the execution of some classic furniture for a music-room of a new house he was erecting in New York. Acting upon Mr. Alma-Tadema's advice, Mr. Marquand came to London, and entrusted the above firm with the commission without limit of price. In 1885 the first portion of the costly and classical furniture was completed, consisting of couches, chairs, stools, cabinets, and tables, made of ebony, cedar, ivory, and boxwood, inlaid with mother-of-pearl, and the tables of Algerian onyx. The "grand" pianoforte has been in hand for three years, and in every particular is in harmony with the suite of furniture. The case is of ebony of the finest quality, enriched by marquetry or inlays of cedar, box, ivory, mother-of-pearl, coral, jeweled here and there with rubies and pearls. We can give but a very inadequate idea of the beauty of the design, the details, and the charming delicacy of color of this sumptuous work of art, destined to receive the instrumental part by the eminent firm of Steinway & Sons, of New York. It is needless to say Messrs. Johnstone, Norman & Co. have carried out their portion of the work with the greatest of skill and good taste, under the supervision of their artist, Mr. C. Codman. On the sides of the case the design is of the most classic character. Round the lower edge runs a band or string of ivory, inlaid with an ebony key-fret of Greek design, studded in the convolutions of the fret with rubies and pearls. Round the top is a member of cedar wood, an egg-and-tongue enrichment of boxwood, finished with a delicate beading of ivory carved with the bead-and-reel ornament. The sides, or ebony ground, between these borders, is decorated by marquetry carved in relief in the form of Greek scrolls; those next the keyboard on each side being of bold classical foliage, chiefly in cedar, ivory, and mother-of-pearl. The same carved and inlaid scrollwork is carried round the back or end of the case, which, being curved at the corners, required the utmost skill and care in manipulation, as each piece of ivory and mother-of-pearl in the volutes had to be cut out of the solid to the circular corners and shaped to the double curvature. Between the Greek scrollings in the centre of each side is a wreath of marquetry. The top side of the piano is inlaid with a series of wreaths enclosing the names of the Muses in Greek characters; these are inlaid in ivory and mother-of-pearl, the interspaces between the wreaths being enriched by ribbons ending in coral and mother-of-pearl studs. The front part of the lid over the keyboard has a central wreath with the name of Apollo. On the under side of lid the surface is formed into panels by Guilloche bands in cedar and ivory inlay, the panels being vellum-covered for the autographs of great players. The music-rest is cut out of one piece of brass inlaid with copper and silver, of very rich design; the Greek anthemion and scrollwork pierced in brass flanks the book-rest and supports the candles. In the centre of the end of case, in the side, is a plaque in repousse silver, with Greek lyre; but the chief work of art remains to be described in the very beautiful composition painted by Mr. E. J. Poynter, R. A., on the "fall" of the keyboard. The scene depicted with so much grace, delicacy, and classic feeling is entitled "The Wandering Minstrels," and represents what we may imagine to be a Pompeian garden scene. At each end are open verandas with trellis-work, their roofs laden with roses and foliage. Under the right-hand trellis sit minstrels playing, at the other sit the chief members of the family, while a centre group of maidens are engaged in the dance. Beyond the garden is a beautiful bay. This work takes the place of Mr. Poynter's contribution to the Royal Academy. On each side ornaments of musical and terpsichorean emblems are introduced.

The side supports are massive, almost Roman in design; they are winged lions carved in old English oak and inlaid; the pedal is thoroughly architectural in design, being a couple of Greek Doric columns fluted in cedar, with entablature, the triglyphs and metopes being delicately wrought. We have before seen costly and beautifully-painted pianoforte cases to which our leading painters have contributed their art; but this one, executed by artists in Messrs. Johnstone, Norman & Co.'s employ, from the design of Mr. Alma-Tadema, R. A., surpasses them in architectural character and in thoroughness of decorative design.

ARCHITECTURE IN THE REIGN OF QUEEN VICTORIA.

IN two subjects not precisely architectural, in the common meaning of the word, but of the highest practical importance, there has been an extraordinary progress during the last fifty years. One of these is the science of sanitation, which may be said to belong to this reign. Fifty years ago the current ideas upon the subject of drainage and ventilation were comparatively of the crudest kind, and it was hardly recognized that the subject was one specially demanding an architect's attention, except so far as some general perfunctory attention to fall and brick traps was concerned. A good many of the artistic architects are much in default in this respect now, but the knowledge that they are so, and that sanitation is a subject which some one, at all events, must attend to, is forced upon them; and in general there is now a degree of study given to the sanitary requirements of buildings which was not dreamed of fifty years ago; a study which, it may be added, has resulted in the condemnation or absolute reversal of some of the sanitary beliefs and expedients of that period. The other subject we refer to is the progress in regard to the improvement in the habitations of the poorer classes, and the recognition, to some extent at least, of the responsibility resting with landlords and with the Government in regard to this subject. The part taken many years ago by this journal in urging attention to this subject is known to all who are acquainted with the history of the amelioration of artisans' dwellings; and though much remains to be done in this respect, what has been already accomplished may count among the architectural achievements of the present reign; and while we have witnessed the foundation of a new cathedral (unfortunately only a good mediæval copy and with no Victorian cachet about it), we may, perhaps, be justified in thinking that the many blocks of healthy dwellings which have been built during late years, not indeed beautiful architecturally, but representing the possibility of decent, comfortable, and healthy housing for the poor, are as important architectural works in their way as cathedrals and churches. In regard to sanitary progress, by the way, it is worth remarking that one of the most recent pieces of work for which public money was voted was the rectification and putting on a proper and efficient footing the drainage of that same great House of Legislation, the commencement of which was nearly coincident with the commencement of the present reign; the architecture was done fifty years ago, and adequate drainage supplied now—a significant indication of the progress in practical matters which has been made during the period we are considering.

Though there has been a good deal said of late as to the desirability of drawing architecture and engineering closer together, as a matter of fact the two professions are farther dissociated in the manner and aspect of their works than ever; and the greatest piece of constructional work at present going on, the greatest in some ways that has been attempted, is the gigantic structure at the Firth of Forth, from which everything that we generally call architectural design has been entirely eliminated, nothing being left, so to speak, but the bare polls of construction. Such a work as this is an appropriate culmination to a half-century in which the most numerous and remarkable constructional works have certainly been those of the engineers. Engineering has known what it wanted, and the public have known what they wanted from it; that is the secret. In architecture there has been doubt and experimenting on one side, and a good deal of public indifference on the other side. As to the latter drawback, we see little immediate prospect of improvement; architecture is still a kind of sealed book, and a subject of indifference to the public, but the art itself appears to be in a healthier and more promising condition than it was at the beginning of the present reign; it has more of life and originality, is less fettered by precedent, and has a sounder basis of sanitary and constructional knowledge; and these are conditions which may make us hopeful for the future achievements of English architecture during the remainder of a reign which we all trust may still be prolonged for many years.

—Abstract from an article in *The Builder*.

THE POUGHKEEPSIE BRIDGE.*

At the meeting of the Society held July 4, J. F. O'Rourke, of the Union Bridge Co., Chief Engineer in charge of building the Poughkeepsie Bridge, read a paper on the origin of the enterprise, progress of the work, etc. Mr. O'Rourke's paper showed that during 1876 the promoters of the project of building a bridge across the Hudson River at Poughkeepsie had surveys made and the engineering features examined. Eminent authorities were consulted as to the possibility of spanning 2,600 feet between the shores with a suspension bridge. Among others, Captain Eads declared the span too long for practicability, and recommended four piers in the river 500 feet minimum space in the clear between. These facts being presented at the following meeting of the Legislature, an amendment of the bridge charter was obtained permitting the construction of the piers. In 1873 the Pennsylvania Railroad Company, as represented by J. Edgar Thomson and A. L. Dennis, subscribed \$1,100,000 in a capital stock of \$2,000,000, and the control of the company passed into the hands of those gentlemen, and the immediate building of the structure seemed assured. The charter required that the work should be begun before January 1, 1874; so a part of a foundation of a pier was built, and on December 17, 1873, the corner-stone was laid with elaborate ceremonies. The financial world was at the time suffering from panic, and money was hard to get. During that winter Mr. Thomson died, and his estate did not wish to go into the work of building the bridge, and the Pennsylvania Railroad Company voted that no new work should be undertaken without the consent of the stockholders, which could not be obtained. So the project rested until 1876, when a contract was entered into with the American Bridge Company, and the actual work of building was begun. The latter company built the pier next to the west shore 20 feet above high water. The crib of the next pier was built 96 feet high, and sunk through 55 feet of water and 40 feet of the river bed, so that the top was one foot above high water. Thirty-six feet of another crib was built, but not placed, and then, in September, 1878, the American Bridge Company suspended work. From that time until last fall nothing was done but to keep the charter alive with extensions. At that time a number of gentlemen forming the Manhattan Bridge Building Company took up the project. That company acquired the rights of the American Bridge Company's assignees and made a contract with the Union Bridge Company for the building of the structure. These companies treated the work as if it was entirely new, regarding the pier and crib as in a sense topographical features, and in September last operations were begun. A line practically the same as the old one was run, a rapid triangulation survey was made, and borings were made through the river-bed to rock. The former design was for rectangular trusses of equal lengths. The position and length of the second span were fixed by the positions of Pier 2 and by the fact of the masonry being 25 feet wide and the charter requirement of 500 feet in the clear between the piers. The same length of span to west would place Pier 1 in the West Shore tracks. At this time a cantilever design had been decided on, and the 548 feet necessary to reach over the highway was adopted for the two other cantilever spans, which, with the connecting ones of 525 feet, located Pier 6 in the face of the bluffs on the east shore. The charter fixed the head-room at 130 feet, and the height of trusses necessary for the spans required the adoption of 212 feet above high water as the grade of base of rail. The west approach of the bridge has a rise of 66 feet per mile, to get out of the valley, and the same grade was adopted on the viaducts. After the adoption of the general design, the next thing was an accurate location, which was accomplished by well-known rules, and the work proper was begun on October 8, 1886, with excavations of foundations for shore piers. The masonry of Pier 6 began December 6, 1886, was finished February 17, 1887; Pier 1 was begun January 7, 1887, and finished March 17. The east anchorage pier was begun February 8 and completed March 23, and the west anchorage pier was begun January 26 and finished May 9. All the shore work is of the ordinary character of first-class bridge masonry, the anchorage piers being an exception. They have built in them iron girders capable of carrying all the pier above if sufficient force were applied to the anchorage bars to raise that much weight. The borings show the river bottom to be various combinations of mud, clay, and fine sand, extending down at least 100 feet below high water. Underlying this pasty stuff is a very firm and hard stratum of rather coarse sand under which is gravel, and about 140 feet down is solid rock extending from shore to shore, and it was assumed that Pier 3 would go to 120 feet below high water; Pier 4, 125 feet, and Pier 5, 135 feet. Briefly describing the cribs, Mr. O'Rourke said a crib or pier is composed of solid timber and concrete 60x100 feet in area and 115 feet in height. On the crib is placed a platform of solid timber, of nearly the same area, on which is built the masonry. Resting on the masonry of each of the piers is a steel tower 100 feet in height, on which rests the lower chord of a bridge truss. The height of the latter, including the floor system, beams, tracks, etc., will be 82 feet, so that from the bottom of the pier to the track is 347 feet, 212 feet of which is above high water. From high water to the lower chord of the bridge the distance will be 135 feet, much higher than the masts of the largest ship in the world.

* Abstract of a paper by J. F. O'Rourke of the Union Bridge Company, read before the American Society of Civil Engineers at the recent Annual Convention.

PRIVATE WATER COMPANIES.

THEIR RELATION TO MUNICIPAL AUTHORITIES AND THE PUBLIC.*

NO ONE could attempt to prepare a paper upon a subject so important as the one assigned to me without feeling a strong desire to know something about the work of those men who were the first to undertake the construction of water-works with private property, and who, doubtless, without suspecting it, introduced by their own success new opportunities for the exercise of judgment and skill in providing pure water for the public good.

Not wholly out of place here would be a paper devoted to a description of the works established in 1581 by Peter Maurice, who rented the first pier of London bridge for five hundred years at ten shillings per annum, and the next season brought out the Mayor and Aldermen to see him throw water over St. Magnus' steeple, "the like of which had never been seen in all London," and the like of which was not seen where promised in some of our own cities three hundred years afterwards. It would also be interesting to turn over the pages of some musty volumes and make notes concerning "these plugs which are no sooner opened than there are vast quantities of water." And "this plenty of water has been attended with another advantage: it has given rise to several companies to insure houses and goods from fire; another advantage which is not to be met with in any other nation on earth."

A little careful study might make it clear that the private water company and the municipal authorities were the happy parents of our modest and thrifty fire insurance company; but there are those better fitted for such investigations, and I trust they may be pursued by some member at a future meeting, when it is to be hoped the necessity for reference to what is being done in our land may not be as great as it is now.

A large, and, I think, an increasing proportion of the members of this association are the superintendents of private companies. Some are in charge of works that are well designed and carefully constructed, and others in charge of works about which fewer good words can be said. Any discussion of the causes that operated to produce in one instance a good plant, and in another a very poor one, will be of interest to you all, and of such causes or influences it could easily be shown that those first exerted are likely to be the most potent. To this class, including the early negotiations between private companies and the authorities of cities, this paper will be limited.

In order to be more easily understood, and because I like the inductive method, of which an excellent example was set for me last season by one of your members, I will beg your attention to conditions that are liable to be met with, merely assuring you that I have not the creative genius of Cervantes, and that I will not lead you to the pioneer city with a boom from which anything ridiculous might be expected.

You may call to mind a city of three or four thousand inhabitants, pleasantly located upon a terrace overlooking a river into which a small creek flows. Within a radius of a mile or two there are two or three beautiful lakes. Good water-power and railway facilities are available, and the city and the surrounding country are in a prosperous condition.

At a September council meeting a stranger appears who says the city is large enough to have water-works, and mentions two or three towns where works have just been built. The Mayor has for some time thought his city needed works; several members of the council have expressed the same opinion, and all see the force of one point made by the stranger. Up to that time water-works had never been built in their city, and might never be unless he (the stranger) built them at once. He would take water from the creek. It was, curiously enough, supplied from springs. He asks to have them appoint a committee to report at a special meeting, as his visit must be short.

Here let me introduce the official record of a special meeting:

"Hon. A. B. C. submitted the report of the committee appointed to examine the creek and its sources. As to the purity of the water, there was no doubt in the minds of the committee; as to its volume, they would not commit themselves, but merely submit measurements of the springs in full as follows:

"Spring No. 1, 20 inches wide and 4 inches deep; Nos. 2 and 3, each 12 inches wide and 2 inches deep; No. 4, 24 inches wide and 6 inches deep; No. 5, 16 inches wide and 6 inches deep; No. 6, 24 inches wide and 4 inches deep, and No. 7, 14 inches wide and 2 inches deep."

You will observe that no reference to velocity is included, and, doubtless, it was not thought of by the committee. Had they given their measurement, spring No. 4 was flowing 1,500,000 gallons per day. They simply cross-sectioned so much more or less stagnant water. But to go on with the record:

"Dr. D. E. F. addressed the council upon the purity of water and suggested more time to consider the subject. A spirited discussion followed which developed an overwhelming sentiment in favor of Blank Creek and a speedy execution of a contract for the erection of water-works."

The stranger departed with a franchise in which the city's interests were undesirably bound up for thirty years or more, and although he might succeed in disposing of it and securing through others the creation of works, the possibilities are that the company willing to pay the

* A paper by H. F. Dunham, read before the annual Convention American Water Works Association, Minneapolis, Minn., July, 1887.

largest sum would build under it the poorest works and do the city the greatest harm.

But it may be urged that this is an instance of contract making without competition, and for that reason quite exceptional and not a fair illustration of actual conditions.

Let us turn over the record—imaginary, of course—of a larger city, population 6,000, where the subject of water-works has been under consideration for several months, and propositions from water-works companies have been solicited through the papers. The city lies upon a gentle slope in the centre of a drainage area about one-third larger than the area of the city itself. The soil is a compact clay resting upon limestone, and the wash from the drainage area and the city streets forms, in a wet season, a small brook which crosses the corporation line through some low ground. Near this brook an old resident has an inexhaustible well. We will also assume that there is no suitable source of supply within a radius of three miles.

For a week previous to the date of opening bids there hung in the council chamber a large map of the city showing by heavy lines the location of the proposed pipes, and bearing in one corner an inscription like this: "Hydrants eighty. Total pipe nine miles, only four or five miles of which need to be of full size."

It is further understood that the pumping station is to be built upon the low ground and within the city limits, otherwise it could not be taxed by the city.

When the bids are opened we need not be surprised to find that each competitor proposed to take water from the point designated by the city. Two of the bids received more attention than any of the others. They named substantially the same rentals and rates. One called for more elaborate and expensive machinery, and the other for better pipe system and a large reservoir. Works constructed under bid No. 2 would cost about \$20,000 more than works to comply with bid No. 1.

The representatives of the two companies, each with a few friends in the council, take in the situation in a glance. They have met before and they meet again in another city. One is not quite certain but he described a larger reservoir than the city needs. The other is very positive that the city needs no reservoir at all. They work together with a common purpose and as one man.

Just here let us imagine—as no such thing would be likely to occur—that one bid was for taking water from a reasonable source three miles away and for a reasonable rental. There would not be a possibility of the acceptance of such a bid. The chances are ten to one that the best bid offered would be rejected and that city, like the one already cited, would be burdened with a franchise in which it requires no engineering or other ability to read future mortality statistics.

I know that when errors are apparent in completed works it is natural to cry fraud and to throw the whole blame at some one's feet, but this paper will fail in its purpose if it does not help us to a wider and in one sense a more charitable view. The bad and the indifferent works established throughout the country are but the natural results of influences, sentiments, business and unbusiness relations which could only be changed very slowly, and they are not well enough understood now to enable any one to foresee or limit the absurdities to which they may give rise.

So long as municipal authorities are profoundly ignorant or culpably indifferent, it may be expected some one will be ready to secure a seeming advantage. To educate and interest such bodies, changed as they are by every political breeze and by every other breeze, is equivalent to educating and interesting the whole community. Turning to private companies, there is more to encourage us. Their standard, although advanced by their own efforts chiefly, is being advanced. From an attempt to make the best possible trade, up to a determination to build only such works in any city as that city ought to have built, is a long step forward and one that was not, or will not be, quickly made.

In the meantime—which is now—any safeguards that will help to diminish the number of ill-assorted contracts ought to be recognized, and that heedless parent, the State, cannot be too severely criticised for neglecting to provide and furnish to every city within her borders such general directions about the character of the works required and the proper source of supply as would go far to ward off the hasty agreement and its ruinous results. In the absence of such assistance organized individual labor would be of great service. Such careful work as that done by the Appalachian Club in topography and geology, would have no less to commend it if it bore a still closer relation to the health of communities. Just how much should be undertaken by scientific men, and the men of leisure, by chemists, engineers, and others, I do not attempt to say, and I urge nothing unprofessional, although I believe that no man's opportunities are lessened by the patient accumulation of facts and the intelligent use of them. We know that when water rises into the atmosphere it is watched by a hundred men, and very probably too, in its course from Puget's Sound to Eastport, if it goes so far, but after it falls to the ground it receives too little notice unless its shadow darkens the page of some physician's journal. In the years before us this must be changed.

TIDY ON TREATMENT OF SEWAGE.

DR. C. MEYMOTT TIDY's paper on the Treatment of Sewage, recently published in the *Journal of the Society of Arts*, has been reprinted by D. Van Nostrand, of this city, and is No. 94 of Van Nostrand's Science Series. In this compact form this valuable contribution to the literature on this subject is now available to any one interested for the small sum of fifty cents.

FILTRATION OR SUBSIDENCE.*

The most Practicable and Economical Method of obtaining a Supply of Clear Water from Streams Carrying Considerable Quantities of Silt.

INFERENTIALLY, the discussion of this topic necessarily takes wider range than the comparative merits of the two systems under consideration—for the mere clarification of turbid waters from running streams, a result which under average conditions can generally be accomplished by either process—variable only as to time and with the distinctive characteristics of the objectionable constituents held in suspension, while soluble coloring matter, as a rule, is practically irremovable by either, or by any other process short of chemical agency. In the case of ordinary filtration, the theory seems a tenable one, that under certain conditions, such as long usage, unfrequent cleansing, etc., the filter, while uniformly producing limpidity and apparent purification, may in reality become a dangerous source of contamination. The fact of effective filtration of sedimentary water presupposes a proportionate clogging of the filter, gradually though steadily reducing its filtering capacity by retaining the lees or residuum within the interstices of the filtering material, a proportion of which, if not speedily and thoroughly removed, tends to harden and become attached to the material, permanently retarding the flow, while another portion is subject to decomposition into soluble gases, their nature and origin depending upon the primal nature of suspended impurities, whether mineral, vegetable, or animal, contaminating the subsequent filtrate with constituents vastly more harmful and also irremovable by any process short of actual distillation.

It is claimed, with more or less semblance of logic, that organic impurities, or the major portion of them, are absorbed and neutralized by the use of charcoal, animal and vegetable, "spongy iron," coke, etc., as a filtering material; that such material, especially charcoal, and possibly coke, will absorb gases to the extent of about eighty times its own volume. Nevertheless, we are unable to reach anything like a satisfactory formula for determining the volume of water that would be actually purified through such agency, or the length of time required for charcoal to become fully charged and inoperative as a purifying agent—when it will cease to act chemically and become, like sand or other filtering material, simply a strainer for removing suspended sediments, conditions which can only be determined by analysis; conditions under which the filter would produce the two-fold result of simultaneous clarification and contamination. The somewhat generally accepted theory that limpidity means purity, being demonstrably illusive, as some of the clearest waters are notoriously the most impure; the outflow from a sewer, for instance, excepting in times of flood, and during flushing, cleansing, etc., is usually "crystal clear" while carrying in solution the most dangerous constituents.

The great difficulty and danger, therefore, in artificial filtration is due to the frequent necessity of thoroughly cleansing the filtering material.

It is both improper and far from my purpose, in the necessarily hasty preparation of this paper, either to portray the merits or to criticise the demerits of the several antecedent or present devices for artificial filtration. The older, and still the more extensive, systems having been designed by, and constructed under, the supervision of engineers of great experience and universally acknowledged ability—some of whose names are still among the most honored in the profession—while the more modern devices are generally covered by letters patent and ably represented by corporate associations. This has had the effect to largely transfer a troublesome problem from regular occasional engineering practice into a speciality, resulting in a wider range and more persistent thought, investigation and experiment.

Without intentional partisanship or discrimination, it may not be amiss to mention in this connection what is termed the "Hyatt Pure Water System," a system which is, doubtless, more or less familiarly known to most or all members of the association. It is claimed to possess the triple characteristics of coagulation, filtration, and aeration, using alum as a coagulant for the purpose of concentrating, solidifying, and rendering insoluble the more objectionable constituents in the water, which are afterwards arrested in the filtering material of sand, and comminuted coke, after which the filtered water is charged with atmospheric air under pressure, for the purpose of oxidizing and destroying the remaining organic impurities. The cleansing process consists in so manipulating valves as to force clear water through the material in reverse currents, raising, intermingling with, and passing rapidly through the filtering material, with the view of removing the coagulated impurities, by attrition and abrasion, and discharging them into outlet drain-pipes.

The use of this, or any other known or established system of artificial filtration in connection with water-works depending upon direct pumping or ordinary stand-pipe service, would necessitate a filtering capacity equal to the quantity of water required during fire service, or a storage capacity sufficient to meet such contingencies; otherwise the pipe distribution would at times be filled with unfiltered water—liable to prove not only objectionable, but also incur more or less expense and delay in blowing off and refilling with filtered water. In either case a low-service pump to supply the filter would doubtless be found a necessary adjunct, owing to the danger of subjecting a

large filter to fire-pressure, and the inefficiency of filtration under such extraordinary conditions, accelerated velocity, etc.

This subject may be regarded as an endless one, taking in its range an almost illimitable field of research, of experiment, of theory, and of empirical results; and while it seems safe to assume as one of the well-learned lessons of the past, that artificial filtration on a large scale has as a rule proven more or less unsatisfactory, owing to the intervention of apparently insurmountable obstacles, it may be equally unwise to assume that a result upon which the well being of so many municipalities is largely dependent can ever be attained.

In contemplating nature's grand system for supplying water so indispensably necessary to the comforts and needs of mankind, we are naturally impressed with the manifold phases which characterize the subject—evaporation, condensation, and descent as rainfall—constant and unceasing transition from pollution to purification and *vice versa*. Atmospheric pollutions begin to attack simultaneously with the commencement of its descent as rainfall, generally with soluble compounds, organic and inorganic. Terrestrial contaminations are carried from the surface into running streams. Subterranean constituents, harmful and otherwise, and of mineral, vegetable, and animal origin are taken in solution during its percolation into the earth—depending for the intensity of objectionable elements upon the degree of earth pollution. But in considering the question within the scope of this topic we have only to deal with the two former sources of contamination; and finally, the efficiency of subsidence as compared with filtration. Each is claimed as an assimilation of nature, and each requiring artificial attention when applied to the purification of a public water-supply. In the one case the sediments are arrested by filtering material, in the other, precipitated to the bottom of the subsiding reservoir. In the one case, if left to decompose, increased and irremediable pollution will follow; and in the other, equally deleterious results will characterize the decomposition into soluble gases, which, under the influence of capillary attraction and variable temperature, may again permeate and intermingle with the water until ultimately drawn to the surface and neutralized by atmospheric oxygen. In order, therefore, to properly and safely realize the purifying attributes of either system, both the arrested sediments in the filter and the precipitate in the subsiding reservoir should be thoroughly removed in advance of the possible commencement of decomposition.

Another point of more or less significance is found in the fact that, with ordinarily turbid water, successful filtration can be greatly augmented by preliminary subsidence.

On the other hand, and aside from the question of limpidity, the filter may prove an important adjunct to the subsiding reservoir.

The filter-bed equally intercepts and removes the fine vegetable fibres, and the minute organism, vegetable or animal, which in all river waters prevail more or less during certain of the summer months. The removal of this class of impurities is getting to be considered in England and elsewhere as of as much importance as the removal of the sedimentary uncleanness which is more apparent. During certain of the summer months, when the rivers usually carry but little sediment, this forms the chief beauty of the filter-beds. The surface of the sand becomes occasionally as much impeded with this matter as with the earthy sediments which more usually clog it, and it is of nature to taint the water under certain conditions more offensively than the other. The sand-filters are therefore considered very important instruments of purification in this relation. They become, indeed, screens of the greatest delicacy, intercepting all material impurities, not the least of which are the very small fish, with which all waters are crowded at certain seasons.*

A comparatively small, inexpensive filter, designed with single reference to the subservience of above purposes, would undoubtedly prove of great value where the supply is taken from open lakes or running streams, as the accumulation of "vegetable fibres and minute organisms," as mentioned by Mr. Kirkwood, is a fact which comes within the range of my own practice.

In view of the great and demonstrable benefits resulting from the prompt and frequent removal of precipitated sediments from subsiding reservoirs, and the well-known annoyance, expense and delay incident to cleaning them by former ordinary methods, I have adopted in recent practice a system of underdrainage, consisting of small openings placed in near proximity under the entire bottom area of the reservoir and connecting them with pipes (vitrified and cast-iron) converging to larger drainage mains, thence into drain-wells in the reservoir embankments; all of which are connected with a main conduit extending safely beyond the reservoirs into open drainage. By this process the entire bottom area of the reservoir can be simultaneously and frequently drained of the major portion of deposited sediments with no other manual labor or expense than the opening of ordinary valves; and during times of great turbidity and excessive sedimentary deposit, the drainage system can be left open, or sufficiently so to promote the constant outflow of precipitated impurities. By this process, also especially with some waters, the reservoir and its drainage system can be kept in simultaneous service—supplying clear water from and near the surface, while discharging turbid sedimentary water from the bottom; the several openings in the meantime creating downward currents proportionately accelerating precipitation, and at the same time securing the well-known bene-

fits due to agitation. In treating extraordinarily turbid waters, two, three or more subsiding reservoirs should be used, and made interchangeable in service, the water being passed from one to the other, and from the surface, either through pipes, or preferably over wide, shallow, overflow wires into a clear water chamber, thence through a thin stratum of filtering material to the pumps and into the general distribution.

I have thus endeavored to advert to the more salient characteristics of the two systems, without feeling called upon to champion the one or to detract from the other. Both may be said to have strong adherents, whose practice and opinions are well worthy of due consideration. For many years few, if any, material modifications were made or sought to be made in filtering devices, but within a comparatively recent period many inventive minds have been turned toward the discovery of various and much-needed improvements with the view and hope of meeting a long-felt necessity. Each and all of such inventions looking to greater safety, inefficiency and economy in this regard should receive the unprejudiced attention and faithful investigation of engineers, superintendents and others in charge of water-works enterprises.

Subsidence, too, although involving nature's great unerring principles, has, also, for many years been palpably defective in the detail of design, and proportionately unsatisfactory in current service. It is, however, demonstrably susceptible to improvements and added appliances which will insure perennial success and safety.

When viewed from any and every conceivable standpoint, this great subject is fraught with an importance second to none, if equalled by any of the almost countless questions with which you have to deal, during your incessant, perplexing and arduous home duties, or that can come within the purview of your joint deliberations.

RECORDING PRESSURE-GAUGES.*

The element of force or pressure in the development, transmission, and utilization of power or energy in the various industries and demands of the world is a very vital one; and the control and regulation therefore of pressure, to serve our purposes with the utmost economy and convenience, assures an importance which can only be appreciated by observing the enormous loss resulting from the spasmodic fluctuations very often noticeable in steam-pressures; not only as far as the effects of variable pressures are concerned, but equally in the direction of *waste* produced by the conditions necessary to cause the unsteady pressure. The main point in prosecuting any sort of enterprise is to know just what we are doing; as from that we can tell just what to do.

In operating steam plants, especially steam plants for pumping water for public supplies, economy in money is the factor to be looked to. By this it is not meant to be inferred that a narrow financial policy is to be advocated, but rather the idea that for any certain amount of total expense per annum, the greatest returns may be realized.

It must be an obvious proposition that to run a water-works plant to the utmost usefulness, a good cool head must know all about what is going on. Of course this proposition extends to various lines, but it is proposed to confine it in this paper to the consideration of pressures of both steam and water; the subject naturally dividing itself into these two parts.

A great deal of money that should appear upon the satisfactory side of the balance sheet, but does not, is absorbed by repairs and losses which need only to be traced to their cause to be prevented.

Disputes as to how quickly a fire-alarm was responded to, and "how high the pressure rose," are of frequent occurrence. The attendants at a pumping station, who know that a good recording-gauge is on guard in the office of the superintendent or chief engineer, are very certain to not only do their best, but also to take a pride in making a good record which cannot be disputed.

It occurs to the writer that a comparison of such records at these meetings would be conducive of improvement, and answer the inquiries as to why such a water-works does so much better than such others, and would induce that diving into matters which is the only way that a knowledge really worth anything is acquired.

The recording-gauge holds within its grasp an encyclopaedia of information concerning fuel, grate-bars, boilers, chimneys, dampers, steam-pipes, engine's suction-pipes, force-mains, fire service, hydraulic elevators, firemen, engines, superintendents, etc., etc.

First, with regard to recording-gauges as applied to steam-pressure. There are plenty of competent firemen ready and willing to attend to their duties, with whom it is an imperative condition that they be thoroughly acquainted with the demands made upon the boilers under their charge. Evidence in the shape of a continuous record of the results of a man's efforts, and the knowledge that this record is being reproduced completely outside of his power to manipulate, can have just one out of two effects either the man must give up his position or do what is required. In spite of all so-called automatic devices for securing uniformity in the performance of steam machinery, a steady steam-pressure in the boilers is more important than any single item involved. In a flouring or cotton mill, for example, an absolutely steady steam-pressure would enhance the value of the automatic cut-off engine, enable it to control the varying load with greater exactness, and produce a closer uniformity in the product.

* Abstract of a paper by J. D. Cook, C. E., read before the Convention of American Association of Water-Works at Minneapolis.

* J. P. Kirkwood.

* Abstract of a paper by Charles A. Hague, read before annual Convention of American Water-Works Association, Minneapolis, Minn., July, 1897.

If safety-valves are supposed to be set at any certain pressure, you can never tell whether they have been tampered with, or whether they failed to blow off when that pressure was exceeded, or how many times a day or night your boilers have been exposed to an excess of pressure. If a careless fireman keeps up his fires too strong toward "stopping time," or when the machinery is brought to rest, a good recording-gauge will completely expose such practice. One of the hardest kind of hard facts in boiler explosions is that they are mostly caused by *overpressure*, and overpressure, whether sudden or gradual, is nearly always caused by careless habits in working boilers. Firing is much easier work when properly understood and manipulated. The position of firemen may be considered an humble one by some folks, but let a fireman see that you care what he is doing and he will take a careful interest in his work. Let him understand that his own grading depends upon himself as established by his record, and let the recording-gauge be the arbitrator.

The mistake under which many people labor, that they need no such record as a recording-gauge will give, can be quickly corrected by a study of the charts which such an instrument produces. The items alone of steam running up above normal pressure and the inefficiency of safety-valves would be found to be very numerous if looked into. When the chart shows a greater pressure than it has been determined to carry, something is wrong that can be remedied. When the chart shows considerable periods of steam-pressure below an economical point, either the boiler or engine is not what it should be, or else the fireman is incompetent; in either event, money is going to waste that can be saved by a knowledge of the facts, and we would have no suspicion even of the deficiency without the record.

The consideration of the water-pressure, as shown by the recording-gauge, involves the performance of the pumping machinery. Of all steam machinery, a pumping engine to do its best must have uniform steam-pressure.

Water-works service in cities may be divided into two divisions—one in which the pressure in the mains is supposed to be constant, the other in which the pressure is held at a certain point for domestic supply, and increased in case of fire. In either case uniformity of water-pressure is to be desired. In gravity works, of course, the item of friction in pipes as set forth by the relation between the supply and demand is the principal disturbing element; a recording-gauge attached to the mains leading to any district will, in the course of a short time, show conclusively whether the pipes are large enough or not, or will locate any trouble in the shape of water-hammer or in the matter of obstruction to flow, from whatever cause.

There pumping machinery is depended upon in part or entirely, it is not too strong to say that a recording-gauge is well nigh indispensable, as fluctuations in pressure from any cause are faithfully portrayed; any failure in fire service giving rise to disputes as to pressure, time, etc., can be readily settled, as the chart shows the precise moment the pressure was increased in response to the alarm, and how long and steadily it was maintained.

Sometimes too many streams are attempted instead of a few good ones. The application of a recording-gauge at various points will soon determine the speediest and cheapest manner of remedying the difficulty. The presence of a water-hammer, caused perhaps by a dead-end or faulty circulation, will be indicated beyond mistake by the sharp and sudden raising of the tell-tale pencil. The writer has in mind a water-works system on the reservoir plan, under a pressure of about 120 pounds, where numerous house boilers commenced to give out that up to a certain day had seemed strong enough. After considerable damage had been done during two or three weeks, it was discovered that the trouble was caused by water-ram, the result of a connection having been made for water for locomotives, and the valve closed very quickly when the engine-tank was full. The application of an ordinary water-pressure gauge graduated up to 300 pounds developed the fact that the static head produced a pressure of 120 pounds at the point of draft. When the engine-tank was being filled through a wide open 6-inch valve, the pressure fell to 85 pounds, and when the valve was quickly closed, as it always was, the pressure ran up to considerably above the 300 limit of the gauge, and after five or six vibrations from just below 100 up to more than 300, the pressure gradually settled down to 120 again. A smaller pipe, an air-chamber and a safety-valve caused the trouble *after it was located*. A good recording-gauge would have rung an alarm and disclosed the excessive pressure the first time it occurred, saving many times its cost. Innumerable instances might be cited. The ordinary gauge drops away and then comes back to the normal pressure or raises and returns again to the regular point—but who sees it? It goes through the same fluctuations as the recording-gauge—but who can read it? With the recording-gauge this is graphically delineated upon a chart, divided off to suit the hours of the day, and even exhibiting when and for how long each sprinkling-cart was drawing water, the precise moment that a pipe burst, and how long before the fractured pipe was shut off from the system, and all irregularity in the operation of the machinery, etc., etc. As to the various kinds of recording-gauges before the public, the principal ones are: The Edson, made by James B. Edson, New York; the Ashcroft, made by the Ashcroft Manufacturing Company, of New York, and the Peerless, made by the American Steam-Gauge Company, of Boston. The Edson instrument is what is known as a diaphragm gauge, while the Ashcroft and Peerless are constructed upon the Bourdon bent-tube principle. The Bourdon instruments are actuated by tubes the same as a regular

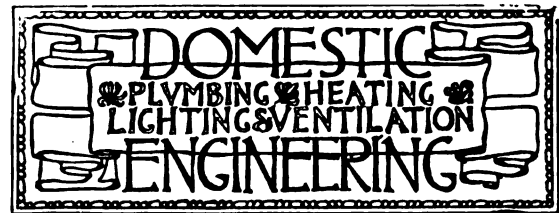
steam-gauge, a small lead pencil being attached to an arm operated somewhat similar to the index of the gauge. The pencil traverses the paper ruled to represent hours, the line drawn by the pencil crossing the hour divisions at a distance from the starting point or zero indicating the pressure, so that the distances of the line from zero at any point between or at the hour lines indicates the pressure at that time. In the Bourdon instruments the charts are moved by clock-work, through a period of twelve hours. The Edson gauge is actuated by a corrugated diaphragm of tempered steel, which, by a peculiar and ingenious mechanism, makes a pencil exactly vertical, and, at the same time, sweeps a regular gauge pointer or index through the arc of a circle graduated to show the pounds pressure per square inch. The spring arm carrying the pencil keeps the point at all times against the paper, while appropriate clock-work moves the paper from left to right to correspond with the hours of the day or night during a period of twenty-four hours. One peculiarity of the Edson gauge, outside of its twenty-four hour clock record, is that the pressure upon its steel diaphragm on one hand, and the resistance of the diaphragm itself on the other, contribute to very great steadiness and certainty of motion, as the work thus done is so greatly in excess of any effort required to move the recording mechanism that the instrument is practically frictionless, the steadiness of its pencil line attesting the value of this feature, even on variations of the pressure to the slightest degree. It also has an alarm operated by the clock through the medium of an adjusting screw, set so as to ring a small gong in the instrument at any determined pressure required. In closing, it may be of interest in connection with this subject to note Mr. Edson's successful efforts to secure four test-gauges graduated up to 300 pounds per square inch. He constructed a mercury column of $\frac{1}{4}$ -inch heavy, hydraulic, wrought-iron pipe at one of the piers of the Brooklyn bridge—then in course of construction—in 1872. The column was carried up to an elevation of 265 feet above the point of observation, it being necessary to carry the pipe up on to the derrick—then at the top of the pier—to get the desired elevation. The manner of dividing the columns, so as to define the different elevations of mercury exactly, was peculiar, and consisted in laying off the pipe with a standard steel scale, and every ten feet a hole one-sixteenth of an inch in diameter was drilled and plugged. Days of the same temperature were selected for the experiments after the column was filled with pure mercury. The levels were obtained by withdrawing the plugs, beginning at the top of the column and letting the mercury escape down to each 10-foot level successively. The indications were recorded upon four gauges made with plain, free Bourdon tubes, selected for the purpose, and with 10-inch dials. This mercury column was the highest ever put up in this country, and probably in the world. The gauges being used only as master gauges are probably as good to-day as when made. These are matters pertaining to the uses to which recording-gauge charts may be put in connection with steam-boilers, the regulation of the fires and economy of fuel in the fire-room which, although not exactly foreign to the subject, would extend this paper beyond a judicious limit. The opportunity may arise for a further extension of the questions involved at some future time.

THE FLORIDA HEALTH PROTECTIVE ASSOCIATION.

UNDER the above title the several county boards of Health have formed an organization for the purpose of perfecting a system of quarantine. The convention for this purpose was called by the Duval County Board of Health. The object in view is a highly commendable one, being to secure uniformity of action, and to remove unnecessary restrictions on commerce by doing away with the so-called interior quarantines, first taking care that effective systems of inspection are established at those points having direct communication with Havana and Key West. Dr. King Wyly, of Orange County, was elected President, and it is provided that the expenses incurred in carrying out the orders of the association shall be met by the several counties *pro rata* according to their assessed valuation.

It is to be hoped that this will lead to a regularly organized State Board of Health with authority and means to do what is required.

DR. EDWARD S. WOOD, of the Chemical Laboratory of Harvard Medical College, has recently sent to Colonel H. T. Rockwell, Chairman of the Boston Water Board, a report on the July analyses of the waters supplied to the city. The principal inferences to be drawn from the analyses are, he says, that the waters of Basins 1 and 3 are about the same condition as in July of last year, but better than in July, 1885. The water of Lake Cochituate is in excellent condition, and that in Basin 4 is very much improved since last October, and is now in very fair condition. Considering the fact that Basin 4 is a comparatively new one, the water is in excellent condition. Both conduits are clean and exert only a beneficial effect. The water at the source in Boylston Street was in good condition also.



HOUSE-DRAINAGE REGULATIONS AT HAVERHILL, MASS.

THE Board of Health of the city of Haverhill, Mass., have lately drawn up a proposed ordinance and presented it to the City Council to be adopted by them to license plumbers and regulate the character of the work to be done by these mechanics. Like similar regulations now in force in many other cities, this code prescribes that all plumbing-work shall be done according to approved methods. Whenever sewers are provided in the streets the abutters are to be obliged to connect their house-drains to them and abandon the use of cesspools and vaults. The usual rules are introduced concerning the use of metal pipes for all soil-pipes and waste-pipes within the house-walls, with proper connections between lead and iron wastes.

Though the general requirements of this code are excellent, corresponding with what has always been advocated in these columns as good practice, some of the details are apparently of questionable propriety—viz.: All water-closets not having windows opening directly to the outer air are required to be ventilated by an "air-shaft up to or above the roof, having an area of not less than three square feet, with an opening to the external air of an equal area. This opening at the top of the air-shaft can be arranged by extending the shaft above the roof and providing a sash of an area equal to that of the shaft, which can be controlled by a cord and pulley from below." Such an arrangement when under intelligent control might give good results for such parts of the year as would yield an upward draft of air in such a shaft from natural causes. But there would be inevitably a period, nearly half the year, when the weather would not create such an upward draft, or when a downward draft would be too cold in our climate to be free from frost.

At such times the shaft could not be left open long without danger of freezing the water-supply, and the result would, in most cases, be that the shaft would rarely be opened except in warm weather. Now it is during the winter months that the interiors of all houses suffer most for lack of ventilation, and when the ventilation of water-closets becomes for this reason of more importance than at any other time. The only effectual means to produce a good result in closets not provided with windows directly to the open air, is to provide a small duct to the open air, through a heated flue, or to heat the duct itself by a gas-burner or hand-lamp. The duct may not be larger than three or four inches in diameter, and may be of zinc or tin or galvanized iron, with an opening under or near the seat of the water-closet for taking air. If connected to a hot flue of a chimney, such ducts should extend quite to the top of such chimney, and where inclosed in the chimney-stack should be of cast-iron or terra-cotta, for tin or any sheet metal in such a position would soon perish.

It is required by these regulations that all "water-closets above the first story of a building must be supplied from a tank, which must not hold less than eight gallons of water for each water-closet," etc. We do not see the propriety of excepting the closets on the first floor from the requirement of a tank, but think that eight gallons is a rather unnecessarily large size for a tank which supplies only a single closet; five gallons is ample in private houses.

In specifying the size of vent-pipes for wastes, the word "ample" is not definite enough. They should always be as large as the wastes to which they are applied.

In providing for foot-ventilation and access to the running trap on the main drain, it is often more convenient to combine the two, and better for other reasons also, by placing the trap in a manhole outside the house, with air-pipe to the curb-stone. The handhole can, in such case, be always left open as an air-inlet.

These regulations leave the trap on the main drain optional when connected with sewers. It is our opinion that a trap on the main drain can be very seldom omitted with safety, and certainly not in a city where the sewers are not fully up to the highest standard as to cleanness and ventilation. We judge that the regulations of Haverhill are not of this high character by

the report of the Board of Health, pages 6 and 7, where reference is made to the very foul emanations from untrapped catch-basins and the need of ventilating man-holes.

These regulations do not include any test for the tightness of newly-constructed house-drains and soil-pipes. In our opinion such a test is of even more importance than in case of the pipes for distributing gas, for the escape of illuminating gas always betrays itself quickly, while leaks in joints of soil-pipes often go unnoticed and unknown till much harm is done. The limit of distance (fifty feet) between a porous cesspool and a well may be quite insufficient in porous soils. Too much caution can hardly be exercised in this question.

With the above suggestions as to minor details, we commend the regulations to the citizens of Haverhill as a step in advance in the matter of municipal government. We notice that in discussing the subject in the City Council they are spoken of as needlessly long and cumbrous. We do not see how they could well be shortened, unless their execution be left entirely at the discretion of the officials, who are not apt to be men of such full information on such subjects as to be able to dispense with such detailed rules as are here proposed. Unless the City Council wishes to show itself to be more than usually indifferent to the welfare of the citizens, they will not fail to put the plumbers under the restraint of a license, and regulate their work by some such code as is here suggested. Honest plumbers will favor such a course, for ignorance and dishonesty always thrive most where no such ordinances exist.

OFFICE OF BOARD OF HEALTH, }
HAVERHILL, MASS., July 7. 1887. }

SIR: We forward herewith a draft of a proposed ordinance relating to house-drainage and plumbing of new buildings in this city which the board has had presented to the City Council to be adopted as an ordinance of the city, together with copies of local newspapers showing the action taken thereon by the lower branch of the City Council.

The board would be greatly obliged for a criticism or any suggestion you may have to offer in reference thereto.

Respectfully yours, CHAS. BRYANT, Clerk.

ORDINANCE FOR THE REGULATION OF PLUMBING, HOUSE-DRAINAGE AND PRIVY-VAULTS OF THE CITY OF HAVERHILL.

SECTION 1. No person shall carry on the business of plumbing unless he shall have first obtained a license and registered his name and place of business in the office of the City Clerk, and notice of any change in place of business of a registered plumber must be given within ten days to said City Clerk.

SEC. 2. Before proceeding to lay, construct or reconstruct any portion of the drainage system of any building, the plumber having charge of the same shall, except in the case of leaks, file with the Board of Health plans and specifications of the whole drainage system, including branches, ventilating pipes, traps, etc., and in case of a privy-vault, a description thereof, giving its position relative to the house and limits of the lot, its size, construction and ventilation; and no person shall commence any portion of such work until the description thereof shall have been approved by the Board of Health, and after such approval there shall be no alterations unless likewise approved. Blank specifications will be furnished to architects, plumbers and others on application at the office of the Board of Health.

SEC. 3. The Board of Health shall be promptly notified in writing when the plumbing-work on any house is completed or sufficiently advanced for inspection; and no part of the plumbing-work of any building shall be covered or in any manner hidden from view until after an inspection has been made, and certificate of approval issued, by the Board of Health or its agent.

MATERIALS.

SEC. 4. Every soil, drain, waste or ventilating pipe above ground, and inside or under the building, shall be of metal. Soil-pipes shall be of iron, sound, free from sandholes, of a uniform thickness and of not less than four inches in diameter; and waste-pipes shall be of iron or lead. The portion of the main drain, within the house-walls and within four feet of the inside face of the cellar-wall, shall be of iron, and shall pass through the wall two inches clear of the masonry on the top and both sides, to avoid injury by settlement. Beyond this point it shall be of "extra heavy" iron pipe, cement or vitrified earthen pipe of suitable size, with a fall of at least one-quarter inch to the foot, unless otherwise permitted.

JOINTS.

SEC. 5. Joints in iron pipes shall be either screw, oakum-packed and lead calked, or carefully and properly made rust-joints; and joints of lead pipe shall be, where practicable and possible, of wiped solder. Joints in cement or earthen pipe shall be made water-tight by means of hy-

draulic cement mortar, and care must be taken that no mortar is left at the joint inside the pipe; and joints of lead with iron pipes shall be made with a brass sleeves or ferrule, joined with the lead pipe with a wiped solder joint, and calked with lead in the iron hub.

CONNECTIONS.

SEC. 6. Connections of branch wastes with the main drain, soil or other waste pipes shall be made so as to change the direction of the flow as smoothly as possible, and when cast fittings are used connections shall be made by means of Y-branches and $\frac{1}{8}$ -bends, except on vertical waste or soil stacks.

WATER-CLOSETS.

SEC. 7. No water-closet shall be set up in any room or apartment that has not a window having an area of at least three square feet opening directly to the external air; they will, however, be permitted in rooms or apartments having no windows communicating directly with the external air, providing that there is an air-shaft extending up to or above the roof, having an area of not less than three square feet, with an opening to the external air of an equal area; this opening at the top of the air-shaft can be arranged by extending the shaft above the roof, and providing a sash of an area equal to that of the shaft, which can be controlled by cord and pulley from below. All water-closets shall be furnished with a sufficient supply of water to keep them at all times clean and well flushed, and water-closets located above the first story of a building must be supplied from a tank, which must not hold less than eight gallons of water for each water-closet which it supplies.

TRAPS AND FRESH-AIR INLET.

SEC. 8. Each fixture shall have an effectual trap close to it—the distance not to exceed two feet—and which, if of a kind and in a position liable to be syphoned, shall be protected therefrom by a properly constructed vent of ample size. As exception, the use of a single trap may be permitted for one set of wash-trays or two adjoining fixtures, consisting of wash-bowls or bath-tubs. In no case shall the waste-pipe from a bath-tub or other fixture be connected with a water-closet trap; nor shall traps be placed on or at the foot of vertical soil-pipes. A running or $\frac{1}{2}$ -S trap shall be placed on the house-drain at an accessible point near the front of the house. This trap must be furnished with a hand-hole for convenience in cleaning, the cover of which must be properly fitted and made gas and air tight. There shall be an inlet for fresh air entering the drain just inside this trap, of at least four inches in diameter, leading to the outer air and opening at or near the street curb, and remote from windows or cold-air boxes. Where, however, the main drain is connected with a common sewer, trapping the main drain shall be optional with builders; but in all cases where the main drain is trapped the fresh-air inlet, as provided in this section, shall enter said drain.

SAFES, OVERFLOWS, REFRIGERATORS.

SEC. 9. Waste-pipes from safes and refrigerators and overflow tanks or cisterns shall empty over sink, trapped gulley or otherwise, as may be approved, but shall not connect directly with the drainage system.

CONDUCTORS.

SEC. 10. Rain-water leaders shall not be used as soil, waste, or vent pipes, nor shall any soil, waste, or vent pipe be used as a leader. When within the house, the rain-leader must of cast-iron with leaded joints; when outside of the house, and connected with the house drain or common sewer, it must be trapped beneath the ground or just inside of the wall, the trap being arranged in either case so as to prevent freezing. In every case where a leader opens near a window or a light-shaft, it must be properly trapped at its base.

VENTILATION.

SEC. 11. Soil-pipes shall be continued full bore up through the roof, without return bend, in as direct a line as possible, terminating at least two feet above any window or opening into the building. All branches of ten feet or more in length shall be continued at full size through the roof, or be taken into the soil-pipes above the highest fixture, unless otherwise permitted by the Board of Health. Any branch less than four inches in diameter to be carried through the roof, shall, four feet before pass-

ARRANGEMENT.

SEC. 12. Soil, drain, waste, and ventilating pipes shall be concentrated as much as possible, and, on the completion of the work, shall be left readily accessible, and in view as much as possible. (It is recommended that the drain, soil, waste, and ventilating pipes and the traps be exposed to view for ready inspection at all times and for convenience in repairing. When necessarily placed within partitions or recesses in walls, soil and waste pipes should be covered with wood-work so fastened with screws as to be readily removed. In no case should they be absolutely inaccessible.) Any house-drain put in and covered over without due notice to the Board of Health must be uncovered for inspection at the direction of its agent or inspector.

WORKMANSHIP.

SEC. 13. The whole drainage and plumbing work of buildings shall be executed by skilled mechanics in a thorough and workmanlike manner.

PRIVY-VAULTS.

SEC. 14. Privy-vaults shall be built of smooth, hard-burned bricks laid with hydraulic cement-mortar and with walls of solid masonry eight inches thick. The whole interior surface shall be coated with cement-mortar, and shall be ventilated in such a manner as not to annoy occupants of neighboring buildings.

PRIVIES.

SEC. 15. No privy shall open directly from any living or food-storage room.

PRIVY-VAULT VENTILATORS.

SEC. 16. No brick, steel-metal or earthenware flue shall be used inside of any building to ventilate any privy-vault, cesspool, trap, drain, waste, or soil pipe, and chimney-flues shall not be used as such ventilators.

CESSPOOLS.

SEC. 17. Cesspools shall be built in a thorough and substantial manner and shall be properly vented. Should the cesspool be located within twenty feet from the cellar, or fifty feet from a well or other source of water-supply, which is used for culinary purposes, it shall be made absolutely water-tight.

SEC. 18. No opening shall be provided in the sewer-pipe of any building for the purpose of receiving the surface drainage of the cellar, unless special permission is granted by the Board of Health, and any opening so made shall be immediately and permanently closed when directed by the Board of Health.

SEC. 19. Subsoil drains shall be provided whenever dampness of site of any building is known to exist.

SEC. 20. On every street provided with a common sewer the sewage from each building shall be conducted into the common sewer, and no privy-vault or cesspool will be permitted upon any premises situated on such street, unless upon permission of the Board of Health in writing. All buildings located on such streets must be provided with water-closets either in the house or yard.

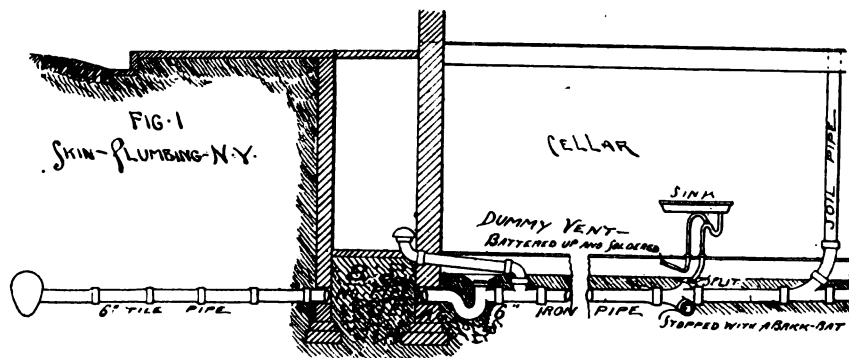
SEC. 21. All drains now built shall be reconstructed whenever, in the opinion of the Board of Health, it may be necessary.

SEC. 22. The provisions of sections 4 to 12, inclusive, of this ordinance shall apply only to buildings erected or to work performed after its passage.

RASCALLY PLUMBING IN NEW YORK CITY EXPOSED BY THE BOARD OF HEALTH.

ON June 10, in the Court of Special Sessions, P. S. Halpin, plumber, of 277 Third Avenue, New York, was prosecuted by the Board of Health on two charges of gross violations of the plumbing and sanitary laws of the city, and convicted and fined in both cases, the fines aggregating \$450.

In the case of four private houses of special design, by James E. Ware, architect, on the north side of Ninety-seventh Street, 225 feet west of Eighth Avenue, of which R. B. Disbrow is owner and builder, he pleaded guilty to



ing through, be enlarged to not less than four inches, and terminate not less than two feet above the roof and remote from windows or openings into the building. Ventilation-pipes shall be of not less than two inches diameter for distances of thirty feet or less, and of not less than three inches for distances of more than thirty feet.

the cellar-drain not being trapped properly; the fresh-air inlets being clogged and out of alignment; no proper alignment to the cellar-drain, three inches only of fall being provided on the length of the house; hubs open and badly calked and poor work generally, as testified to by the inspectors of the Health Department.

In this case he pleaded guilty, as before mentioned, throwing the blame on a deceased partner in business and on his employees, and, in consideration, was let off with a fine of \$200. The inspector was C. A. Hollick.

In the second case the house was by the same owner and builder, at One Hundred and First Street, seventy-five feet east of Ninth Avenue. It was a tenement-house for eleven families, from designs by A. B. Ogden & Co., architects, just built, and four families had moved in.

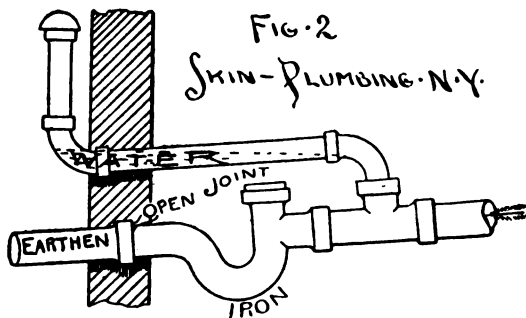
In this case the plumber (P. S. Halpin) pleaded not guilty, but the evidence of the Chief Inspector of the Health Department, Mr. John C. Collins, and his assistant, W. H. Titus, developed the following facts: Vent-trap at basement sink was a dummy (as shown in Fig. 1). It was run under the floor, where it stopped, and was closed and soldered at the end, and was clearly arranged to deceive the inspector; the hub into which the sink pipe entered was badly split; the other hub of the same Y was closed with a brickbat and some mortar. Open joints were found in other parts of the house by the permit test.

Mr. A. L. Whitelaw, master plumber, of 391 Fourth Avenue, who was engaged to remedy the defects and perfect the job, also discovered that 8 feet of the house-drain outside the house-trap was missing. This is plainly shown in the diagram Fig. 1. The house-sewer was of 6-inch earthenware pipe, run to the area wall. The house-drain was of 6-inch cast iron to the front area of the building, but the space intervening through the area was not excavated and no pipe was laid in it, the sewage forcing itself through the ground in the cellar. The plumber was convicted on this charge and fined \$250, and would probably have been sent to jail were it not that he again blamed his deceased partner and claimed that he was not morally responsible, not knowing the actual condition of affairs. The tenement had been sold to a Mr. Johnston.

James Barry was arrested for doing bad plumbing in twelve houses, west side of Ninth Avenue, between One Hundred and Fifth and One Hundred and Sixth Streets, New York City.

The owner of these houses was Lawrence Weiher, of New Rochelle.

There were split house-drains and pipes in Nos. 1841, 1851, and 1853, and the owner would not remove them when requested by the department. They were puttied and



painted to deceive the inspector, and the plumbing was poor generally. In No. 1853 there was little or no "pitch" to the house-drain, and the fresh-air inlets were defective in being low at the outer elbows, so they filled with condensation or from water that would run over by a stoppage of the trap. Fig. 2 shows how this was done.

MORE DUMMY VENTS.

H. Z. Norton, plumber, was arrested June 2, for dummy vents put in three or four years ago.

At that time he did the plumbing of twelve houses on the east side of Madison Avenue, between One Hundred and Twentieth and One Hundred and Twenty-first Streets. He was then arrested, and fined \$50 in the Court of Special Sessions, and his plea was, "his workmen imposed upon him," and he made a show of making all right. Now, however, in Nos. 1851 and 1855, three dummy vents have been discovered in each house during the overhauling of the houses, and he is arrested again, but his case has not yet been brought to trial. The vents of the basin-traps were carried through the floors, and there stopped. Mr. Louis M. Hopper was the inspector.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
July 23.....	26.62	20.57	21.72	28.21	26.05	21.27	29.15

E. G. LOVE, Ph.D., Gas Examiner.

THE Board of Electrical Control, of New York City, met on July 15 and adopted the following rules governing the erection of telegraph and telephone poles and wires. At a subsequent meeting this action was reconsidered, and the rules have been referred to an electrical expert for examination and report. The rules have been approved by General Newton, Commissioner of Public Works:

No two lines of poles shall be on the same side of any street or avenue.

No two lines of poles bearing conductors for similar electrical service shall be on any street or avenue.

Electric-light poles shall be of iron, at least 25 feet in height, with a diameter of not more than eight inches at the base, and having cross arms of wood, with glass, porcelain, or rubber insulators, and painted a uniform color.

Poles for telegraph, telephone, and other similar wires shall be at least 60 feet in height.

Poles shall be placed upon the sidewalk, as near the curb as possible, and no pole shall be placed within 10 feet of any lamp-post or other pole.

All existing regulations of the local authorities in regard to the placing of poles and stringing of wires are to continue in force.

All wires shall be fastened upon poles or other fixtures with glass, porcelain, or rubber insulation.

No wires shall be stretched within one foot of any pole without being attached to the same with glass, porcelain, or rubber insulation. No wires shall be stretched within 20 feet of the ground or within four feet of any building, except when attached thereto with glass, rubber, or porcelain insulation.

No arc electric-light or power wires shall be stretched over any part of any house or other building.

The companies or persons owning or controlling poles in any street or avenue shall allow the same to be used by other companies or persons operating conductors for similar electrical service when authorized so to do by the board on tender of proper compensation, to be determined by agreement between the companies or persons interested. In default of such agreement, the amount of such compensation shall be determined by the board. This rule imposes a contract on the part of each company or person owning or controlling the poles in any street or avenue, not only with the board, but also with each company or person who shall under its terms be qualified to demand the privileges it confers.

All permits of the board for overhead wires and fixtures are granted only pending the providing of underground accommodations in the neighborhood of the street or avenue for which the permit is granted.

Any member or officer of the board, and every inspector employed by it, as well as every member of the police force of the city, shall be entitled to examine permits under which work of any kind is being done.

No permit shall be granted for the erection of any overhead structure, nor for the renewing of any lines already existing in any street, avenue or highway in which underground accommodations for the service have been provided or are being provided.

All poles now standing, or to be hereafter erected, shall be branded or stamped with the initials of the company owning them, at a point not less than five or more than seven feet from the street surface.

When an old pole is taken down, it must be removed from the street the same day.

New poles must not be brought upon any street more than two days in advance of their erection.

Any pole that shall be on the street more than two days shall be removed by the Bureau of Incumbrances of the Department of Public Works at the expense of the party owning it.

All electrical companies or persons having poles in the public streets shall give a bond to the city, in a reasonable amount, to be determined in each case by the board, conditioned for the payment of the cost of renewing dangerous and abandoned poles, and also for the payment of the expense of restoring the sidewalks and pavements where the same have been disturbed or injured in consequence of the erection or removal of any poles owned by them.

The violation of any of the rules and regulations of the board shall operate *ipso facto* as a revocation of the permit held by the company or person guilty of such violation.

The Chief Engineer was ordered to report the present condition of pole and wires and to suggest any necessary change. He was also empowered to nominate one Chief Inspector at a salary of \$250 per month, and eight inspectors at \$4 per day.

Chief Engineer Kearney submitted plans for the digging of conduits, which, he believed, could be dug at from three to seven feet from the curb. The question came up of whether the gas-pipes laid in the streets could be removed as obstructions to the underground work; legal advice is to be obtained. Gen. Averill said that it was his opinion that iron pipes laid in hydraulic cement rotted in a very short time. He wrote to the Superintendent of Public Buildings in Chicago, who had had some pipe removed from that sort of cement in a building in that city. The answer was that the pipe had to be removed because it had corroded and had become so rotten in places that it crumbled. Engineer Kearney said he considered hydraulic

cement better than any other material for the purpose; the anchorages to the Brooklyn Bridge and the Suspension Bridge at Niagara were laid in it. A recent examination showed them to be in excellent condition. It was decided to consult Mr. McNulty, one of the engineers of the Brooklyn Bridge, as to his opinion on the subject.

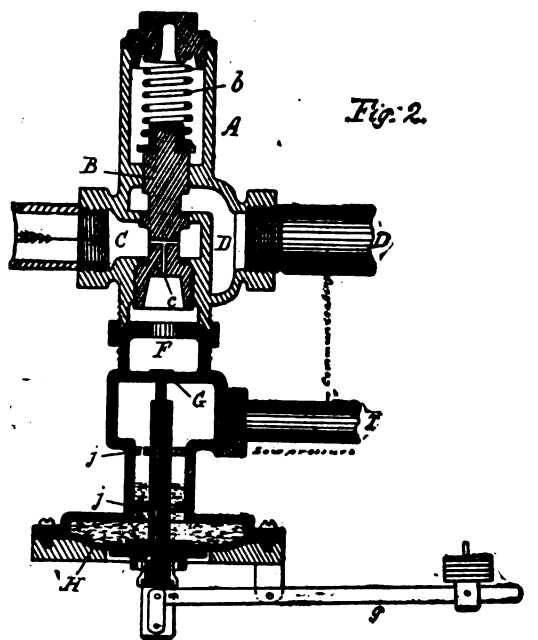
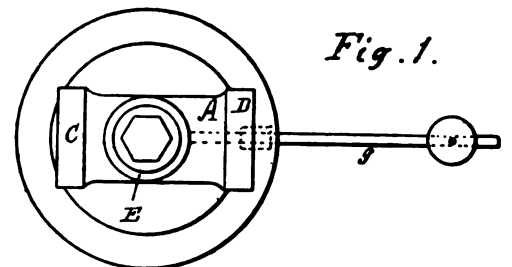
Novelties.

PRESSURE-REGULATOR.

THE accompanying cut shows a novel modification of pressure-regulator for fluids, and is the invention of Joseph E. Watts, of Lawrence, Mass.

The invention consists in the general arrangement and method of operating the main valve, which is a "balanced" valve, so called, whereby the movement of the latter is effected more gradually and the low-pressure system is not subjected to such extreme fluctuations as usually occur where the main valve is not balanced; in boring the main valve in such manner that the rear side of the valve, when the latter is closed, shall be subjected to the initial or high pressure in contradistinction to valves employed in regulators of this class, in which the rear side of the main valve is connected with and open to the low-pressure system when the said valve is closed. The drawings represent in Fig. 1 a plan, and Fig. 2 a central vertical section. It belongs to that class in which a weighted pulsating diaphragm operated by the variations in the low-pressure system serves to control a secondary valve, which in its turn regulates the movement of the main valve to admit or shut off steam under initial pressure, such opening and closing of the main valve being accompanied by an increase or diminution of the pressure in the low system to maintain the latter uniform and somewhat less than that of the said initial pressure.

A represents the exterior casing of the valve as an entirety, which is hollow and centrally provided with a "plunger-balanced" valve, B, so called, which reciprocates



ates through the internal division-wall, and controls the passage and regulates the supply between the inlet-passage C and the discharge D. The upper end of the main valve extends into a tubular cap, E, which incloses the actuating-spring δ . The main valve B is bored at c, as shown, by which a duct is formed leading to a closed chamber, F, normally open to and under the initial pressure. The lower part of the chamber F is furnished with a port, d, controlled by a secondary valve, G. The latter is connected by the valve-stem e with a pulsating diaphragm, H, which controls this secondary valve and forms the bottom of a hollow well, f, to be filled with water from the condensed steam, to prevent sudden jumping or resilient action of the diaphragm.

The reduction or difference in pressure between the initial supply and low-pressure system is effected by means of a weighted lever, g, and by the adjustment of the weights thereon the action of the diaphragm is controlled and regulated.

SPECIAL REPORT OF THE CHICAGO DRAINAGE AND WATER-SUPPLY COMMISSION.

Messrs. RUDOLPH HERRING, Chief Engineer, Benesette Williams and S. G. Artingstall, Consulting Engineers, as the Drainage and Water-Supply Commission of Chicago, have made a special report on the "Diversion of the Flood-Waters of the Desplaines River and North Branch of the Chicago River," and on improving the condition of the South Fork, from which the following is abstracted:

As a part of the final project to dispose of the Chicago sewage into the Illinois River, it was recommended that hereafter no flood-water should pass into the lake through the Chicago River, and thus periodically endanger the water-supply. This flood-water, which comes partly from the North Branch, and partly from the Desplaines River through the Ogden-Wentworth ditch, can be otherwise disposed of. Sufficient capacity can be provided for it in the proposed channel to the Illinois River, or it can be diverted into Lake Michigan before it becomes polluted by its passage through the city. The latter disposition is advised.

The commission after citing at length the reasons for the position taken in the report then proceeds:

As the bill authorizing the Desplaines and North Branch diversion has now become a law, it is deemed important to proceed with the execution of the work at the earliest possible moment, because the territory through which the proposed channel is carried is rapidly building up, and the property is increasing in value.

The diversion can be accomplished along various routes, each with some specific advantages.

The fact that the North Branch lies between the Desplaines River and the lake makes it evident that the Desplaines will first have to be turned into the North Branch and subsequently the combined waters of the two streams carried into the lake. The most practicable point at which to divert the Desplaines is immediately north of the town line, between Leyden and Maine. The distance along this line is the shortest, and the excavation and damage to property the least.

From the North Branch to the lake the two lines which are considered most feasible are as follows: One extending from near the north line of Niles township to the lake near Winnetka; the other from Bowmanville eastward through Lake View to Lake Michigan.

Preference has been given to the latter route.

Then follows a description of the diversion channel, from which the following is abstracted:

As a result of the investigation it has been concluded that the channel from the Desplaines to the North Branch should be given a capacity of 10,000 feet per second, with a mean velocity of five feet, or a section of 2,500 square feet, and the channel from Norwood Park to Lake Michigan a capacity of 12,000 cubic feet per second, the section from Bowmanville to the lake to be 21 feet in width and 18 feet in depth below the city datum. The distance from the Desplaines to the lake is 11 1/2 miles.

Norwood Channel.—The channel of diversion will slant at the Desplaines River, three and three-fourth miles by the course of the river below the village of Desplaines and at the first easterly bend above the south line of the town of Maine, in Section 34.

The centre line of the channel will continue the course of the river above this bend by an easy curve to a line parallel to and 200 feet north of the township line between Maine and Niles on the north and Leyden and Norwood Park on the south, until the valley of the North Branch is reached at a distance of 10,400 feet, or three and seven-tenths miles. A strip 100 feet wide and bounded by the township line on the south will be required for right of way.

The proposed channel of diversion is designed to carry 10,000 cubic feet per second from the Desplaines without sensibly altering the height due to a flood of that volume. This channel will conduct floods of any other height without materially changing their level. Ordinary floods are less than that of 1887 and do not reach a damaging height.

The velocity in great and unusual floods will be five feet per second, giving a cross-section of 2,000 feet. An economical section for this channel will have a depth of 16 feet, a bottom width of 100 feet, and side slopes of three horizontal to two vertical. The width at the flood-line will be 143 feet. The maximum depth of cut at the summit will be 57 feet, or 40 feet above the flood-line, and the greatest width will be 271 feet. The flow-line will lie sufficiently below the general level of the prairie and the bluff level of the Desplaines at the west end. It will lie above the prairie level for about 2,000 feet at the east end, where it will be retained by broad levees of from one to seven feet in height. This will not interfere with the natural drainage of the prairies.

The Desplaines River dam will be simply an embankment raised to an elevation of 55 feet above datum, or five feet above high water of 1881. In fact the immediate valley can be entirely filled as far as the Higgins Road, about three-fourths mile below. The flanks of the valley may also be filled above so as to narrow the present overflow area without impairing the hydraulic condition.

North Branch Channel.—The length of the first reach from the weir west of Milwaukee Avenue to the proposed location of the weir in the North Branch will be 7,100 feet, or one and one-third miles.

The crest of the weir will be set at 10 feet above datum and will be 200 feet long. The depth of the water flowing in over it will be seven feet, or 12,000 feet per second.

It is proposed to excavate a section with a bottom width of 150 feet to a depth of 12 feet below the flow-line and on a grade parallel thereto.

The route for this excavation is a centre line of a belt 400 feet wide, shown on the map, which belt represents fairly the available width of the valley. Generally the cut will be shallow.

The second reach extends from the east line of section five to a point one-fourth mile west of Western Avenue at Bowmanville, a distance of 23,750 feet, or four and three-eighths miles. The route follows the bed of the stream to the Bowmanville Bridge, thence easterly one-fourth mile north of Lawrence Avenue.

Bowmanville Channel.—The section from Bowmanville to Lake Michigan begins one-fourth mile west of Western Avenue on the north and continues in a straight line one-fourth mile north of Lawrence Avenue to 500 feet beyond the shore-line of the lake, 12,000 feet, or two and one-third miles.

The right of way will extend from the south line of Webster Avenue on the north to the north line of Tuttle Street on the south, and be generally 500 feet wide south from the east and west line of Webster Avenue.

It is proposed to dredge and dock a channel 210 feet wide and 13 feet deep below city datum. The cutting for about one-third the distance will be less than ten feet above datum, for another third from fourteen to eighteen feet, and at the highest point, on the Green Bay Road, twenty-five feet. The cut will require side slopes and a berme at dock-level. A considerable portion of the material above datum will be sand or soil. The balance of the cutting will probably be in clay.

At the lake end a pier will extend 300 feet on the north side and two, three or four feet deep depth of water on the south. These piers are not intended to reach a navigable depth.

From the main channel, one-fourth mile west of Western Avenue, it is proposed to make a single dredge-cut or initial channel southward along the North Branch. The course will be one-fourth mile west of Western Avenue to Graceland Road, and thence general course of river to Belmont Avenue. A strip one-eighth mile wide for right of way should be reserved.

To entirely prevent the water of the Desplaines from entering Chicago River by the Ogden-Wentworth ditch will require a dam and levee nearly one mile long across the head of Mud Lake Valley, near Summit.

The total estimated cost is \$2,695,617.

Discussing the subject of the improvement of the South Fork the report says:

The project of drainage via the Desplaines River, recommended by this Commission in the preliminary report, involves the extension of the western end of the South Fork in a westerly and northerly direc-

tion to the Ogden-Wentworth ditch, and thence to the Summit. For the immediate amelioration of the condition of the South Fork until the final completion of the main canal, it was also recommended that the western arm of the South Fork be extended along its proposed permanent line to the Illinois and Michigan Canal, where a new pumping station was to be built.

As there is nothing temporary in this plan except the pumping works, and as further consideration of the question confirms this commission in its previous conclusion, the recommendation is repeated that the western arm of the South Fork be extended along the most practicable route to a point on the canal north of Thirty-ninth Street and west of the Chicago and Grand Trunk Railroad, and that pumping works will be built near the canal with a total capacity of 45,000 cubic feet per minute.

There are no improvements on the proposed line. The channel will be 10,500 feet, or two miles in length, and should be excavated to an average depth of thirteen feet below datum, and sixteen feet on the bottom, with side slopes one and one-half horizontal to one vertical. Such a channel will carry 30,000 cubic feet of water per minute with no greater velocity than that existing in the Illinois and Michigan Canal. By selling permits to brickmakers, this channel can be widened and deepened in a few years to any desired extent and a revenue derived therefrom in the meantime.

To keep the eastern arm of the South Fork in a sanitary condition, it will be necessary to build an intercepting sewer along its south side from Halsted Street to a point on the west arm, so that all sewage will be discharged into the current established by the pumps.

The cost of improving the South Fork as herein recommended is estimated at \$653,000.

In conclusion the report reads:

With the present powers of the city of Chicago and the town of Lake and the concurrence of the Canal Commissioners, it is practicable to carry out the work proposed in this report. With the diversion of the Desplaines and North Branch, the construction of a dam across the Desplaines Valley at Summit, and the improvement of the South Fork as recommended, Chicago will have much greater immunity from contamination than at present, while the sanitary condition of the Chicago River will be better than it has been for many years and the navigation of the Illinois and Michigan canal will be improved. The total expense of this work is estimated at \$3,348,617 and the time in which it can be completed at two years.

INSPECTORS OF PLUMBING, TORONTO, ONT.

THE first examination of candidates for the position of Inspector of Plumbing, under the lately enacted plumbing by-law, was held on the 6th and 7th inst. in the City Hall. There were eight candidates. The examiners were the City Engineer, the Medical Health Officer, Mr. S. G. Curry, architect for the Toronto Sanitary Association, and Messrs. I. Ritchie, Sr., and W. I. McGuire, for the Master Plumbers' Association. The examinations were all written; no orals were given. The inspectors will be attached to the Water-Works Department. It is intended to appoint only one for the present. He will have plenty to do.

LEAD-POISONING IN DYE-WORKS AND ITS PREVENTION.

IN a recent number of the *Glasgow Medical Journal* Dr. Alexander Scott describes a number of cases of chronic lead-poisoning occurring in a large dye-works where chromates of lead are much used, and gives some sensible advice for its prevention. The great danger is from the presence of these lead-salts in the air in the form of a fine dust, and efficient ventilation is one of the great safeguards. On the recommendation of Dr. Russell, the Health Officer of Glasgow, ventilators were placed in one of the rooms, and for the next six months those working in that room escaped disease.

The symptoms of this kind of poisoning are at first slight and easily mistaken for dyspepsia; the complexion becomes dull and sallow, the spirits are depressed, there is loss of appetite and some pain in digestion, and for a time this is all that is noticed.

Dr. Scott urges the use of a respirator when working in the poisonous dust, the wearing of linen overclothing, which should be frequently washed, frequent bathing and thorough cleanliness, frequent washing out of the mouth, the use of a weak sulphuric acid lemonade and a small dose of Epsom salts once a week.

CAMBRIDGE, MASS., LIBRARY PLANS.

MR. FREDERICK RINDGE, now residing in California, a son of the late Hon. Samuel Rindge, of Cambridge, Mass., has made a generous donation to his native city of Cambridge which has been accepted. The Dana Library, which has been in existence for a number of years, is the only institution in Cambridge that can be said to approach a public library, and although it fulfilled the ideas of the founder when it was created the constant increase of population since has rendered it practically of no value at the present time. Mr. Frederick Rindge, who appreciated the condition of things, has donated to the city as a site a tract of land in a central location, valued at about \$55,000, and has agreed to contribute \$75,000 toward the erection of a suitable building. The city of Cambridge has accepted the gift and will meet any deficiency in excess of the sum proposed by Mr. Rindge. The first step toward carrying out the purpose of the donor has been in asking five architects, Messrs. Chamberlain & Whidden, Peabody & Stearns, W. P. Wentworth, Van Brunt & Howe, and McKim, Mead & White, to furnish competitive designs on or before August 15.

CINCINNATI CITY HALL COMPETITION.

THE plans submitted by Samuel Hannaford & Son, in the competition for the designs of the City Hall, have been selected by the committee as the best, and Mr. Hannaford has been appointed Superintendent of Construction. The cost of the building will be about \$600,000. Work will be begun early in September.

THE Massachusetts Supreme Judicial Court has recently decided that the town of Brookline is liable in damages in causing a well to dry up in consequence of the construction of a system of sewerage, notwithstanding the well was not upon land taken for the purposes of the sewer nor adjacent to it.

JAMES INGRAM, since 1846 a master plumber and inventor of New York City, died in this city July 21, aged 78 years. Mr. Ingram was born in Belfast, Ireland, and came to America in 1846, entering the plumbing business, which he was connected with until 1878, when he suffered from a stroke of apoplexy, from which he never fully recovered. For the last year of his life he was confined to his room. He was the inventor of a number of improvements in sanitary appliances, among them a pan water-closet, a movable water-back range, and an iron sink. From 1866 to 1872 he was sanitary inspector to Board of Health of this city, and since 1852 a member of the Society of Mechanics and Tradesmen. His wife and five children survive him.

PERSONAL.

JOSHUA T. HEALD, founder of the Delaware Western Railroad, the Wilmington street-car system, and the sinking fund for the extinction of the debt of that city, died July 25, in his sixty-eighth year.

MR. W. L. CAMERON, who has for over fifteen years been secretary and superintendent of the Memphis Water Company has resigned the position of secretary and been appointed general superintendent of the company.

LIEUT. CHITTENDEN, U. S. Engineer Corps, lately stationed at Willet's Point, N. Y., has been transferred to Omaha, as Engineer Officer, Department of the Platte.

MR. JAY STONE has resigned his position as Chief of the Correspondence Division of the War Department and accepted the Secretaryship of the Board of Army Engineers, of which Col. Thomas Lincoln Casey is President.

CHIEF ENGINEER THOMAS WILLIAMSON, U. S. N., has been appointed Superintendent of the State, War and Navy Department Building in the place of the late Chief Engineer Snyder.

HYGIENE DE LYON. Compte rendu des travaux du Conseil d'Hygiène publique et de Salubrité du Département du Rhone, 1800-1885. 466 pp., 8vo. Lyon: A. Storck. 1887.

This volume, which is entitled "Première Partie," indicating that others may follow, is prepared by Dr. A. Lacassagne, the Secretary of the Council of Health, and contains meteorological statistics, the geology of the place, and accounts of the water-supply, streets, sewers, schools, hospitals, cemeteries, etc., with the laws and municipal regulations affecting, and an account of the improvements which have been made or which are in progress.

By the census of May 31, 1886, Lyons had a population of 401,930. The mean annual death-rate for the last five years has varied between 22 and 24 per 1,000, while the birth-rate has been slightly less and appears to be diminishing. The total number of inhabited houses in 1885 was 15,798, containing 118,164 distinct sets of lodgings.

The questions of water-supply and of sewage disposal have not yet been settled satisfactorily, and the reports on these subjects are largely occupied with discussions of the relative merits of various schemes which have been proposed.

A contemporary (*Industries*) states that Messrs. Chaudet & Naudin, of Paris, have lately introduced a new scheme of ventilation for textile mills, the idea being to obviate the excessive dryness of the air, which is detrimental both to health and to the threads of fabrics. They accomplish this by the introduction of steam. Air and steam are distributed by zinc tubes running through the work-room, pierced with 1/2-inch holes at 4-inch intervals. An air-propeller of 20 inches diameter, discharging 7,000 cubic feet per minute, is said to suffice for a room 110 feet long, 80 feet wide and 15 feet high. Steam is blown into the propeller at the inlet, and is thereby mixed with the air as it passes through the fan and tubes.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS

NEW YORK CITY.—The Grant Monument Association have received designs from a number of American and foreign sculptors and architects, including C. Vaux, of New York; Joseph Echleter, of Bavaria; George Matthias, of New York; Max Schreff, of New York; W. G. Steinmetz, of New York; Mr. Story, of Rome, Italy.



Persons who make any use of the information they find in these columns we trust will not omit to mention **THE SANITARY ENGINEER AND CONSTRUCTION RECORD** as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 229-230-231-232.

WATER. SEWERAGE. ETC.

ST. CLOUD, MINN.—Proposals for purchasing the water-works were received as follows: Hiram Upham, Minneapolis, \$15,000; H. W. Phelps and E. T. Sykes, Minneapolis, \$19,000; C. E. Gray, Fergus Falls, Minn., \$20,000.

NORFOLK, NEB.—A. L. Strong has the contract for building water-works here at \$3,900 per annum for 50 hydrants.

ALLENTOWN, PA.—The contract for a pumping-engine capable of pumping 3,000,000 gallons of water daily against a head of 210 feet, has been awarded to the Knowles Steam Pump Company at \$17,900. A list of bidders was given under issue of June 25.

MARINETTE, WIS., has rejected proposals received July 2 for water-works and will try to arrange for a supply with the Menominee Water Company.

SIDNEY, O., proposes to make improvements in the water-supply at a cost of \$80,000.

RICHMOND, VA.—Address Col. Bolling about the proposed new filtering reservoir.

ST. LOUIS, MO., proposes to spend \$219,000 on extensions of its water service.

WASHBURNE, WIS.—Water-works will be built here.

LINCOLN, NEB.—Joseph Burns has proposed to furnish an additional 2,000,000 gallons of water daily at \$8,855.

KALAMAZOO, MICH., wants additional water-supply.

ORANGE, N. J.—The sewerage question is under discussion. Health Officer Buttner proposes a system of disposal to cost about \$250,000, of this the disposal works to be erected immediately at a cost of \$25,000.

LAFAYETTE, IND.—W. R. Coates, C. E., of Kalamazoo, Mich., has just reported on the changes needed to put the water-works in good condition. He puts the cost at \$43,500.

HUMMELTOWN, PA.—F. J. Schoffner will obtain a charter for a company to build water-works here.

MILLEDGEVILLE, GEO.—The contract for water-works has been submitted to City Council, and as soon as they sign it the works will be pushed forward.

EXETER, N. H.—The Exeter Water-Works will inquire into the cost of a filtering-plant.

MANSFIELD, MASS.—A town meeting will soon be held to see if the town will accept a charter granted by the Legislature a year ago to build water-works for fire and domestic purposes. If it will not, then to see if the town will agree to pay the Mansfield Water Company a certain sum for the use of water for fire purposes.

ALLISON, IOWA, wants water-works.

OSHKOSH, WIS.—There is a movement on foot for the city of Oshkosh to purchase the water-works plant, which is at present owned by a few citizens, and is valued at \$340,000.

ERIE, PA.—City Engineer Platt proposes to secure fine water by sinking a well on the Peninsula and letting the water of the lake filter into it through the sandy soil.

MERRILL, WIS.—C. D. Barstow, of Muncie, Ind., has charge of the work of constructing water-works for this city.

ALBANY, PA., July 25.—Judge Albright to-day overruled a motion for a preliminary injunction restraining the city from erecting new water-works. Councils in February ordered that the Fountain House property of sixteen acres be purchased and water-works erected thereon, the improvement to cost \$50,000. The people at the municipal election decided that the public debt should be increased by this amount. Several prominent citizens protested, and their protest took the form of a motion for a preliminary injunction, which the court has refused to consider. A motion was then made for the appointment of a master to take testimony, and the court has appointed S. A. Butz, Esq.—*Philadelphia Press*.

CRETE, NEB., July 21.—"Sealed bids will be received by the City Clerk of Crete, Neb., up to September 6, 1887, for the construction and maintenance of a

system of water-works for the city of Crete on franchise system. Franchise to be given for twenty-five years. Plans and specifications will be ready in a very few days, and will be mailed to any party desiring to bid.—F. D. Williams, City Clerk."

NORTH PLATTE, NEB.—"A franchise has been granted the American Water-Works and Guarantee Company, Limited, of Pittsburgh, Pa., for a term of twenty years, the work to be completed by July 14, 1888, and are to be begun by September 15, 1887.—E. B. W."

RUSHFORD, MINN.—Our correspondent writes: "There will be nothing done towards establishing water-works in this city."

MINNEAPOLIS.—The Council Committee on Streets has voted to recommend the construction of the Nicollet Avenue sewer and a connecting branch on Twenty-fifth street, from Nicollet to Fifth Avenue south.

MARSHALL, TEX.—Address W. Windham, resident engineer, about the sinking of artesian wells for water-supply; cost, \$50,000.

ABERDEEN, DAK.—The question of sewerage is being agitated. Another artesian well is talked of. W. B. Sweet is the president of the new pressed-brick company just organized.

STILLWATER.—Messrs. N. Johnson & Sons have been awarded the contract for laying about three miles of pipe for the Hudson water-works. The bid was \$7,000.

CANON FALLS, MINN.—A water-works system will be built. Address F. B. Slager.

CANISTO, N. Y.—Incorporated is the Canisteo Water-Works Company; capital, \$25,000. C. D. Barstow, G. R. Harlow, J. H. Harlow, of Pittsburgh, Pa.; E. J. Harlow, Lowell, Mass., and others, incorporators.

CLOQUET, MINN.—The Cloquet, Minn., Water Company is incorporated; capital, \$20,000. J. E. Page, J. L. McCullough, J. F. McGarvey, and others.

MILWAUKEE.—A brick sewer will be laid in Fowler Street, from Thirtieth to Thirty-second Streets. Pipe sewers will be laid as follows: Garfield Avenue, Seventh to Eighth Streets; Sycamore Street, from Thirtieth to Thirty-first Streets; Second Street, from Wright to Clark Street; Knickinnick Avenue, from Lincoln to Smith Street. Water mains will be laid in Twenty-eighth street, from Grand Avenue to Clybourne Street; also in Orchard Street, from Sixth to Seventh Avenue.

MEMPHIS, TENN.—The city is having a contract drawn up with the Artesian Water Company, by which the latter is to furnish a supply of water from wells.

TORONTO, ONT.—Water-Works Superintendent Hamilton has prepared a scheme for a new reservoir on Wells' Hill, to be supplied through a three-foot pipe from pumping-engines which he would recommend should be placed either beside the present pumping-engines where the city had sufficient vacant and taking the water from the lake by a conduit, pumping the water into the proposed new reservoir through pipes to be laid along Bloor and other streets. He favored putting new pumping-engines somewhere near Mimico, and thereby saving the great cost of a new conduit across the Toronto Bay. Mains from pumping-engines at Mimico to a reservoir at Wells' Hill would be cheaper than a new conduit across the Bay. The present reservoir is about 212 feet above the Bay. The proposed new reservoir would be about 300 feet above the Bay.

GREENSBORO, N. C.—The Board of Aldermen have engaged E. W. Bowditch, C. E., of Boston, to make a survey for water-works.

OAKLAND, CAL.—Mr. J. H. Woodward has bonded 513 acres of the Laundry farm back of East Oakland, and also 100 acres of the Hooker and Camden tract near by. It is rumored that the land is to be secured for the purpose of constructing water-works. It covers a water shed of twenty-four square miles, sufficient to afford an ample supply of water to Oakland, Alameda, and Berkeley. It is understood that a large amount of capital is interested in building on the land reservoirs and other water-works.

SPARTA, WIS., wants a pump for fire protection.

CLINTON, WIS., is discussing the building of water-works.

MILLBURY, MASS., is applying to Worcester to extend the latter's mains to supply Millbury with water.

MADISON, WIS., is considering the lake as a source of water-supply.

JANESVILLE, WIS.—The Janesville Water Company has been incorporated.

MILWAUKEE.—A 6-foot brick sewer will be built in Washington Street on the South Side.

VAN BUREN, ARK.—Our correspondent writes: "The City Council has accepted a proposition from the Water, Light and Power Co., of St. Louis, Mo., to construct water-works, the Water Co. reserved thirty days for their acceptance and filing of bond. The time has expired and the Water Co. have failed to file their bond. I am in correspondence with them, but cannot tell whether we will have water or not. If the contract is consummated I will inform you."

MECHANICSTOWN, MD.—Our correspondent writes: "We have commenced the construction of water-works; the reservoir has been completed and lies 170 feet higher than our town, distance 1 1/2 miles. Over one mile of the trench has been dug for the laying of pipe and we expect to have all completed by September 1. We get our water from the mountains from a pure stream of spring water."

FLORENCE, ARK.—Contracts have been let and work will commence August 1.

PASADENA, CAL.—The city has voted \$102,000 bonds for sewerage; only two votes were cast against the proposition.

The San Francisco Sewer-Pipe Company was the successful bidder for 5,600 feet 20-inch and 7,050 feet 18-inch vitrified sewer pipe; price \$1.40 per foot for 20-inch; \$1.20 for 18-inch pipe.

WYTHEVILLE, VA.—A committee consisting of Messrs. J. W. Caldwell, H. B. Maupin, H. G. Wadley and Isaac Frank, have been appointed to contract for the construction of water-works and electric light plant.

SENeca, S. C.—Efforts are being made to establish a system of water-works.

FORT SCOTT, KAN., will have complete new pumps, boilers and stand-pipe to cost \$200,000. Their capacity will be to furnish 2,000,000 gallons of water per day.

BIRD CITY, KAN.—Our correspondent writes: "Our city has voted bonds to the amount of \$5,000 for the purpose of putting in a small system of water-works, and negotiations are now pending and the contract will probably be let in a few days for the construction. John H. Humlog is City Clerk."

TUSCALOOSA, ALA.—Our correspondent writes: "The establishment of water-works is being considered by our City Council and will be decided in a little while. The City Clerk is A. P. Hogan."

KAUKAUNA, WIS.—Our correspondent writes: "The question of water-works at our last special meeting was laid on the table for further consideration."

AUSTIN, MINN.—Our correspondent writes: "We have prepared plans and specifications for a system of water-works at this place. We shall lay from four to five miles of pipe, size, 4, 6, 8 and 10-inch. We shall use the direct-pressure system. Domestic supply will be taken from four to six wells. For fire purposes we will connect with the Cedar River. Have purchased grounds. Commenced to sink wells. We intend to put in machinery and about two miles this season."

CHATTANOOGA, TENN.—The Board of Public Works is preparing to construct sewers, to cost \$50,000.

PROVIDENCE, R. I.—The Board of Public Works opened the bids, July 21, for the laying of the iron water-pipe to connect Hope Reservoir with the proposed station at Fruit Hill, and awarded the contract to James J. Newman, of this city. The distance is about four miles long, and it will require about 2,500 tons of 24-inch pipe and castings. The work will be commenced August 1, and will require at least three months for completion. The bids for the construction of the reservoir at Fruit Hill will be opened on August 9, the required capacity of the receptacle being 25,000,000 gallons, which is about one-half that at Sochanoset and one-third that at Hope Station.

KALAMAZOO, MICH.—We have received a letter from Mr. W. R. Coates, Hydraulic Engineer, of this city, from which we extract the following items of interest: "Relative to South Williamsport, Penn., and Columbia, Mo. water-works, I have made investigations, estimates, and reports in both these cases recently. I doubt if either of these places build works this season. Petersburg, Ill., where I have recently made plans, has voted to go forward and build the works at once. I have just returned from Lafayette, Ind., and send you by this mail a Lafayette paper with a notice of what I have been doing there. I go to Benton Harbor and St. Joseph, this State, to plan water-works improvement for those cities, and from there to West Superior, Wis., for a similar purpose."

BISMARCK, DAK.—With reference to water-works here, our correspondent writes: "All pipe and other material required in quantities for the work here is purchased by Morison & Corthell, Civil Engineers, Chicago, 205 La Salle Street."

SEATTLE, W. T.—The Spring Hill Water Company is building a reservoir on Ridge Lawn, to hold 4,000,000 gallons of water. New pumps will be erected.

WHITEWATER, WIS., wants bids for water-works, and H. S. Salisbury, City Clerk, will receive same.

WATER-WORKS are proposed in the following places: Cuba, N. Y.; Castile, N. Y.; Atalla, Ala., (L. P. Brown); New Glasgow, N. S.; Skaneateles, N. Y.; water-works company; Manitou Island, Minn.; water-works company.

DENVER, COL.—The Mayor and heads of departments are discussing the construction of a complete system of sewers. The Mayor estimates the cost at \$150,000.

MONTGOMERY, ALA.—The proposition made by George A. Ellis, of Durham, N. C., to construct a system of sewerage, has been accepted. Work will be begun about October 1.

LExINGTON, VA.—The question of enlarging the water-works is being considered by the City Council.

KISSIMMEE, FLA.—The question of water-works is being agitated. The City Council are conferring with Newark Filtering Company, of New York; Peter Herdie Company, of Orlando, Fla., and others, in regard to the matter.

DAVID CITY, NEB.—Plans and specifications for water-works are being prepared by A. A. Richardson, C. E., of Lincoln, Neb. He will also prepare the plans and specifications for water-works at Loupe City, Neb.

WILLIMANTIC, CONN.—Plans for sewerage have been prepared by the Committee. A town meeting to take action will soon be called. Address George W. Mahony, of the committee.

NEWBURG, N. Y.—The Board of Water Commissioners are investigating methods of increasing the water-supply. Engineer Garrison is preparing an estimate of the cost of laying a 30-inch iron pipe from Silver Creek to Washington Lake.

MARTINEZ, COL.—Gas-works are talked of here.

MOTT, SISKIYOU CO., CAL., will have water-works. The machinery has arrived.

SANTA CRUZ, COL., is agitating the sewerage question.

TORONTO, ONT.—The committee appointed to inspect the water-works of Buffalo, Rochester, New York, Philadelphia, Boston, and other cities has returned and will report soon.

NEWBURG, N. Y.—The Committee on Sewers have under consideration the construction of a trunk sewer from West Newburg to the Hudson River.

ALTOONA, PA.—The Water Commissioners are just advertising for proposals for finishing Kittanning reservoir, and for 16-inch pipe. A contract for pipe and special castings has been given to R. D. Wood & Co., of Philadelphia.

BRANTFORD, ONT.—Mr. Haskins, of Hamilton, Ont., Water-Works, has reported in favor of driven wells at Holmesdale for increasing the water-supply. He has also reported on a sewerage system.

MANCHESTER, CONN.—Dwight Spencer contemplates introducing water in the north village. The reservoir he proposes to build will be nearly a hundred feet above the post-office. It will be located half way to Manchester Green and will flood about an acre. It will be fed entirely by springs, and will supply a 4-inch pipe. Work has already begun on the reservoir and pipes will be laid as soon as patrons enough are secured to guarantee interest on the investment.

WATER-WORKS.—Bids were opened at Charles City, Ia., July 20, and the contract was awarded to the Eclipse Wind Engine Company of Beloit, Wis., for the piping and machinery for the sum of \$14,900. The city build the buildings, and flume, and foundation. The bids for Valparaiso, Neb., will be opened at Valparaiso July 30. Plans were prepared by A. A. Richardson, C. E., of Lincoln, Neb.

CHICAGO.—Manufacturers of pumping-engines should watch developments. It is probable that bids for new engines will be asked for in connection with the new water-works tunnel.

CANTON, MASS.—At a special meeting this week the town voted to accept the act providing for the obtaining of a water-supply. On August 10 three water Commissioners to obtain works will be appointed.

LAPER, MICH., is to have a system of water-works. For further information address C. G. White.

CROOKSTON, MINN.—The Crookston Water Power and Light Company will improve their plant.

COLUMBUS, O.—Messrs. R. Curtis, J. Kilroy, and L. W. Sherwood, Water-Works Trustees, propose enlarging their plant.

LINCOLN PARK, CAL.—The Lincoln Park Land and Water Company has been incorporated with a capital stock of \$12,000. J. A. Woods, J. P. Early and others, incorporators.

MONTREAL, CAN.—The Road Committee has annulled the contracts for sewers, recently awarded, as exceeding the appropriations, and is considering the advisability of advertising for new bids.

CATONSVILLE, MD.—The Catonsville Water Company has awarded to T. C. Bashor & Co., of Baltimore, the contract for putting up an iron stand pipe, or water tank, 25 feet in diameter and 50 feet high, with a capacity of 185,000 gallons of water. It will be constructed of half-inch boiler iron, and will cost \$6,000. The company has also contracted with the McNeal Pipe and Foundry Company, of Burlington, N. J., for 450 tons of iron pipe, the delivery of which will be commenced on August 10. The Worthington pump, which was ordered some time ago, will arrive on August 1. It has a capacity of 500 gallons per minute. Mr. William Gerwig, of Catonsville, has been awarded the contract for putting up the pump and boiler-houses. The pump house will be 16x24 feet, and the boiler house 16x16 feet. Both will be of wood, one story high. The original \$30,000 worth of stock has nearly all been taken, and a meeting of the directors will be held in a few days to consider the advisability of issuing the remaining \$30,000 worth authorized by the charter. Water will be supplied to subscribers in Catonsville by September 1.

EMPORIA, KAN.—The city is considering the renewal of a lease or the purchase of the water-works owned by it.—T. Soden.

OROVILLE, CAL.—The Butte and Yuba Orange Belt Irrigating Canal Company was incorporated here July 19, with a capital of \$1,000,000. They have the right to 100,000 inches of water from the main Feather River, taken out about seven miles above this town and carried along the citrus belt of Yuba and Butte counties. The incorporators represent over \$1,000,000 of cash capital. The surveying of the canal has already begun, and the work will be pushed to a rapid completion.

GAS, STEAM, BUILDINGS, ETC.

ROCHESTER, MINN.—Incorporated is the Rochester Electric-Light Company; capital, \$30,000. It will supply electricity for light and motors.

SIoux CITY, IOWA.—A company is forming here to prospect for natural gas.

NEW LEXINGTON, O.—City Council has contracted with the Union Electric Light Company to light the streets, the contract running five years.

BENNINGTON, N. Y.—At a special village meeting recently the trustees were instructed to contract with the Bennington Electric Light and Power Company to light the streets in whole or in part by electricity. The company estimated that twelve arc and sixteen incandescent lamps would sufficiently light all the principal streets, the outskirts of the village to be lighted by gas-oil and kerosene, but there are seven miles of streets to be lighted, and it is thought by many that the number of electric lamps proposed is too small. The contract is to run for five years at an annual expense of \$1,600.

MARTINEZ, CAL.—It is proposed to build gas-works here.

PHILADELPHIA.—A contract for constructing a purifying-house, pans and connections at the Ninth Ward Gas-Works has been let to James R. Floyd, at \$25,200.

SAN ANTONIO, TEX.—Rids for lighting the streets have been received by Mayor Callaghan as follows: The San Antonio Gas Company, \$3 per street lamp per month for one year, or \$2.75 per lamp monthly if the city will contract for two or more years; new posts \$22 each; gas for public buildings, \$2 per 1,000 cubic feet. The company will also furnish electric lamps at \$64 per annum for arc lights; for incandescent lights, 16 candle-power, \$23 per annum.

The Southern Electrical Construction and Supply Company will erect a tower for 2,000 candle-power arc lights, to be lighted until 1 A. M., for \$15 per month, and 300 18 candle-power incandescent lights at \$28 per lamp per annum, lighted 4 hours a night. Also it is offered to maintain 2,000 candle-power arc lights, all night and every night, for \$70 each per annum, and 16 candle-power incandescent lights, all night and every night, at \$25 per annum.

The Electric Light and Power Company will maintain 2,000 candle-power arc lights at 90 cents per lamp per night each, and 16 candle-power incandescent lights at \$25 per lamp per annum, lights burning all night; the lamps to be lighted 24 nights in each month.

HARRISBURG, PA.—Charters were issued from the State Department July 25 as follows: The Overhead Conductor Electric Railway Company, of Pittsburgh; capital, \$300,000. The company proposes to purchase and sell patent rights for electric railway purposes. The Union Building and Loan Association, of Pittsburgh; capital, \$200,000. Presque Isle Natural-Gas Company, of Erie; capital, \$11,500.

BROOKLYN, N. Y.—A certificate of incorporation of the Brooklyn Heat and Power Company was filed at Albany, July 2. Its objects are to manufacture and sell hot water, hot air or steam, and to lay pipes for conducting hot water, steam or hot air through the streets, squares, and in public and private buildings of the city of Brooklyn. The amount of capital stock is \$25,000. The incorporators and trustees are Theodore M. Vail, of Boston, Mass.; David B. Park, of Randolph, N. Y., and Delmore Elwell, of Brooklyn.

FLUSHING, L. I.—Next Monday, August 1, John H. Wilson, President of the village, will sell a franchise for electric-lighting for the streets.

GREENFIELD, MASS.—Gas Company has reduced the price of gas to \$2.50 per 1,000 cubic feet, with a discount for prompt payment.

BENNINGTON, VT.—Town meeting has empowered the village trustees to make a contract with some electric-light company to light the streets by electricity.

FERGUS FALLS, MINN.—The following were elected officers of the Fergus Falls Brush Electric Light Company: President, Charles L. Lewis; Secretary, F. G. Barrows; Treasurer, James Compton. The capital stock is \$15,000; continuance, thirty years. The company has closed contracts with the Heysler Electric Company, St. Louis, for two dynamo engines with a power of 340 lamps, thirty-candle, and will put in a steam plant, fifty horse-power.

ERIE, PA.—On Monday the Presque Isle Natural-Gas Company will open proposals for sinking a gas-well to a depth of 4,000 feet if such depth be necessary.

PALESTINE, TEX.—Mining and Petroleum Company is organized.

MARBLE FALLS, TEX.—Address A. R. Johnson about gas-works to be built here.

HALIFAX, N. S.—The City Council received bids July 27, for lighting the streets by electricity, as follows:

Halifax Gas Light Company: 1. For 100 arc lights, of 2,000 candle-power each, within a radius of one and a quarter miles from the post office, and including lights on Gottening Street to Young Street, and on Campbell Road to Richmond, \$70 each per annum.

2. For any extra arc lights, of 2,000 candle-power, within the above limits, \$70 each per annum.

3. For any additional arc lights, of 2,000 candle-power, beyond the above named limits to the extent of half a mile, \$80 per annum.

4. For 50 incandescent lights, of not less than 50 candle-power, within the limits described in clause No. 1 as above, \$28 each per annum.

5. For any additional incandescent light, of not less than 50 candle-power, beyond the limits described in clause No. 1, to the extent of half a mile, \$32 per annum.

Halifax Electric Light Company: 100 arc lights 2,000 candle-power, at \$90 a year; 50 incandescent lights, 50 candle-power, at \$25. Additional incandescent lights at the same price. Each additional arc light at \$50 a year.

The bids were referred to the Board of Works.

NORFOLK, VA.—Bids for lighting the city, 1,200 candle-power electric lights, were received July 25. The American Electric Light Manufacturing Company, of New York, proposed to light 155 lamps, by the moon's schedule, for \$12,245, and to light the city buildings for \$775. For lighting the city all night and every night they bid \$14,000.

The Brush-Swan Company, of Norfolk, the present contractors, agree to light 155 lamps, by the moon's schedule, for \$12,167.50, and to light the city buildings for \$756. For lighting the city all night and every night they bid \$13,950.

The bid of the Brush-Swan Company for lighting the city all night and every night, and for lighting the city buildings, amounts to \$14,706 per annum, as against \$14,775, bid by the American.

The committee recommended that the Brush-Swan bid be accepted.

RAILROADS, BRIDGES, CANALS.

RAILROAD.—A railroad will be built from Kalkaska to Elk Rapids, Mich.

ASHEVILLE, N. C.—Chief Engineer Ramasour, of the Carolina and Knoxville Railroad, is pushing the surveys of the line.

BUFFALO, N. Y.—President Wilson S. Bissell has had a consultation with E. M. Leuffer, the recently appointed Chief Engineer of the Buffalo and Geneva Railroad, and General Superintendent Stevenson of the Lehigh Valley, the result of which, it is said, will be the speedy completion of the new line, which will be a link in the Lehigh Valley system. Bids for laying the 205 miles of track will soon be asked for.

HARRISBURG, PA.—A charter was issued last week for the Monongahela East Shore Railroad Company, of Pittsburgh, with a capital of \$50,000, to build a line about two miles long. Charles Donnelly is president of the company.

OTTAWA, ONT.—Cummings' bridge will be rebuilt in iron and stone.

CHICAGO.—The Metropolitan Railway Company, with a capital of \$2,000,000, filed articles of incorporation at Springfield, July 23. The object is to build an underground railway under the city of Chicago, to reach nearly all the townships in Cook County and form a belt railway.

AVONDALE, N. J.—The Board of Freeholders will advertise for new bids for a bridge. The first lot were rejected.

WHEELING, W. Va.—The Secretary of State, July 26, granted a certificate of incorporation to the Wheeling Electrical Railroad Company, and the corporation has made application to Council for permission to maintain a track through certain of the principal streets of the city commencing at Main and Tenth and running to and through the town of Benwood, in Marshall County. The track is to be commenced in four months and cars are to be running in one year.

PLATTSBURG, N. Y.—The Chateaugay Railroad, between Plattsburg and Loon Lake, is being extended from Loon Lake westward to Saranac Lake, a distance of about eighteen miles, and will be completed before winter.

LAWRENCE, MASS.—The contract for the iron work on the new Union Street bridge at Lawrence was awarded July 20 to the Boston Bridge Company, the cost to be \$19,700, and the work to be completed by February.

BROOKLYN.—A bridge will be built over the Canal at Carroll street. The plans have not yet been decided upon.

PHOENIX, ARIZ. will have a street railroad.

BROOKLYN.—The Department of City Works has approved the plans of the Union Elevated Railroad for a structure on Myrtle Avenue and other streets.

GREENSBORO, N. C.—A franchise has been granted to Dr. J. W. Griffith to establish a street railway. Work will soon begin.

BROOKLYN.—The appropriation of \$100,000 in the budget for the present year for street repairs will be expended on the following streets, which are to be paved with granite blocks: The upper part of Bedford Avenue, running out to Greenpoint; Manhattan Avenue, from Bedford Avenue to Greenpoint Avenue (which is to be widened two feet and regraded); Prospect Place, from Union street to Eighth street; Fourth street, from Union street to Grand street; Hancock street, from Bedford to Nostrand Avenues.

NEW YORK.—A syndicate, composed of New York and London bankers, has agreed to furnish the money necessary for the construction of the Chattanooga, Rome and Columbus Railroad; and President Williamson, who has been in this city conducting negotiations, will begin work on the line at once.

RICHMOND, VA.—The Virginia Construction Company, of this city, has contracted with the Tennessee Midland Railway Company to build 135 miles of the latter's road.

DENVER, COL.—city engineer has recommended the construction of an iron bridge on Nineteenth Street to cost \$35,000. The matter is referred to a committee of the Board of Aldermen.

ST. PAUL.—The Railway and Navigation Company was incorporated here July 25. Capital stock, \$10,000,000. The incorporators are citizens of St. Paul. The object is to build a road from the Twin Cities to a point on Lake Superior, and a new line of boats in connection therewith. It is to be an extension of the Minnesota and North-western.

MILWAUKEE.—The West Side Street Railway Co. has a bill before the Council petitioning to lay tracks and run cars from Wisconsin Street on Marshall to Brady, and on B-ady Street to Cambridge Avenue.

It is proposed to build a cable road from Chestnut Street to Wauwatosa, passing through a road built on Mr. Schoonmaker's property. This will do away with the objections that have been raised to the Blue Mound Road project.

The Cream City Railway will extend its tracks from North Water Street over Pleasant Street bridge, and on Dock Street to Island Avenue, thence north on Island Avenue to North Street, east on North to Booth, and north on Booth to city limits.

The Milwaukee City Railway is petitioning for the above right of way, but the Cream City Company will get it.

WINONA, MINN.—The directors of the Winona and Southwestern held a protracted meeting July 24 to decide upon plans for building the road. L. J. Monroe and General A. B. Nettleton, representative of Minneapolis syndicate, and General Jones, of Chicago, are conferring with them, each offering to build the road.

LITTLE ROCK, ARK.—The Desha and Eureka Springs Railroad Company, capital stock \$1,150,000, has been incorporated to build a railroad from Eureka Springs to Pendleton, 210 miles. The directors are George P. Bangs, William L. Stowe, E. E. Pratt and H. M. Cross, of Boston, Mass., and James Murphy, W. B. Dutton and others, of Arkansas City, Ark.

RAILROAD.—Major G. B. Phinney is in charge of the surveys of the St. Louis, Kansas City and Colorado Railroad, which is being pushed toward Clinton, Mo.

CHICAGO.—The Chicago, Rock Island and Pacific Railroad Company will replace the wooden viaduct at Twelfth Street with one of iron costing \$200,000. The city pays \$200,000 of this amount.

SYRACUSE, N. Y.—Franchises to lay tracks for street railroads have been granted by the Aldermen to the People's Railroad Company and the Third Ward Railway Company.

LAWRENCE, MASS.—The Bridge Committee has awarded the contract for building the piers and abutments of the new bridge across the Merrimack River to Trumbull, Cheney, Meulton and O'Mahoney. The bids are as follows: For all granite laid, \$24.50 per cubic yard; rubble, \$5.75; rip-rap, 75 cents.

INDIANAPOLIS, IND.—The State Line and Indiana City Railway Company filed articles of association July 25. It is the intention of the company to construct a line of road about twenty-five miles in length from the Eastern Illinois boundary to Indiana City, on Lake Michigan. The capital stock is \$500,000, and the following are the directors: J. T. Torrance, Carroll N. Towle, William H. Gostlin, James S. Prentiss, and Thomas W. Johnstone.

Articles of consolidation of the Leroy and Eastern, an Illinois Company, and the Lebanon and Western, an Indiana railroad, have been filed. The roads connect at the State line, and will hereafter be known as the Rantoul Railroad Company, with headquarters at Chicago. Stuyvesant Fish, B. F. Ayer, J. C. Welting, John Dunn, and Henry De Wolfe are named as directors of the consolidated Company's affairs.

BRIDGE.—The Boston and Providence Railroad Company has had plans prepared for rebuilding the Bussey bridge.

BIDS OPENED.

GALVESTON, TEX.—The contract to deepen the Galveston Harbor has been awarded to Messrs. Fagin & Burke, of Mobile, Ala.

LITTLE ROCK, ARK.—Synopsis of bids received by the Board of Public Affairs for 1,400 feet of 6-foot brick sewer, circular, from Fourth and Louisiana Streets to the Arkansas River: Patrick Powers, \$11,000; G. P. C. Rumbough, \$10,010. \$1 per cubic yard extra for rock excavation; E. A. Weigel & Co., \$7,950, 50 cents per cubic yard extra for rock excavation. Contract awarded to E. A. Weigel & Co.

NEW HAVEN, CONN.—Abstract of bids for sewers' opened July 30, by A. B. Hill, City Engineer: Lawrence Street, Orange to Whitney, L. O. Breen, 30-inch sewer, \$5 per lineal foot; 24-inch sewer, \$3.50 per lineal foot; 12-inch culverts, \$1.50; catch-basins, \$1.15 each; manholes, \$40 each; total, \$6,020.

A. Brazos & Sons, \$5.40; \$3.65; \$1.25; \$100; \$40; total, \$6,325.

Matthew Kehoe, \$5.25; \$3.75; \$1.25; \$103; \$52; total, \$6,395.

Anthony Carroll, \$6; \$5; \$1.50; \$130; \$50; total, \$7,770.

Sachem Street and Winchester Avenue: A. Brazos & Sons, 24-inch sewer, \$4.15 per foot; 18-inch sewer, \$1.98 per foot; 12-inch culverts, \$1.50 per foot; 12-inch culverts, \$1.25; catch basins, \$100 each; manholes, \$48; total, \$2,434.50. Contract awarded.

M. Kehoe, \$5.50; \$2.35; \$1.40; \$1.10; \$100; \$50; total, \$2,475.

M. S. & J. H. Austin, \$5.50; \$3.40; \$2.60; \$1.50; \$120; \$60; total, \$3,715.

Anthony Carroll, \$5; \$3.25; \$2.40; \$1.50; \$115; \$55; total, \$3,475.

Bristol Street: Matthew Kehoe, 24-inch sewer, \$3.65; 15-inch sewer, \$1.58; 12-inch culverts, \$1.25; catch-basins, \$100; manholes, \$50; total, \$4,317.30. (Contract awarded.) A. Brazos & Sons, \$2.65, \$1.55, \$1.25, \$100, \$50; total, \$4,335.50. Anthony Carroll, \$4.75, \$2.70, \$1.50, \$125, \$55; total, \$6,129.50. M. S. & J. H. Austin, \$5.50, \$3, \$1.50, \$118, \$62; total, \$6,867.

Cottage Street: A. Brazos & Sons, 15-inch sewer, \$1.65; 12-inch sewer, \$1.10; 12-inch culverts, \$1.25; catch basins, \$100; manholes, \$50; total, \$1,370.50. (Contract awarded.) M. Kehoe, \$2.25, \$1.10, \$1.10, \$50, \$50; total, \$1,505.50. M. S. & J. H. Austin, \$2.50, \$1.45, \$1.25, \$115, \$55; total, \$1,670.50. A. Carroll, \$2.80, \$1.90, \$1.30, \$115, \$60; total, \$2,008.

Woolsey Street: A. Brazos & Sons, 15-inch sewer, \$1.50; 12-inch culverts, \$1.25; catch basins, \$100; manholes, \$50; total, \$1,210. (Contract awarded.) M. Kehoe, \$1.95, \$1.25, \$1.10, \$55; total, \$1,372.50. M. S. & J. H. Austin, \$2.30, \$1.40, \$1.15, \$55; total, \$1,573. Anthony Carroll, \$2.40, \$1.40, \$1.15, \$65; total, \$1,650.

Nicol Street: A. Brazos & Sons, 5-inch sewer, \$1.70; 12-inch culvert, \$1.25; catch basin, \$10; manholes, \$60; total, \$612. (Contract awarded.) M. Kehoe, \$1.85, \$1.30, \$1.05, \$50; total, \$619.50. A. Carroll, \$2.75, \$1.25, \$1.15, \$55; total, \$827.50.

Dixwell Avenue: A. Brazos & Sons, 12-inch sewer, \$1.12; 12-inch culvert, \$1.25; manholes, \$50; total, \$945.70. (Contract awarded.) M. Kehoe, \$1.40, \$1.20, \$50; total, \$1,114. M. S. & J. H. Austin, \$1.55, \$1.60, \$55; total, \$1,245.50. A. Carroll, \$2, \$1.65, \$60; total, \$1,542.50.

PITTSBURG, PA.—The following bids for constructing the Western Penitentiary of Pennsylvania were received by E. M. Butz, architect, July 27: For stone and brick-work.—Harrold & McDonald, Pittsburgh, \$120,900.

John Schirmer, Allegheny, \$119,950.

Morrison Bros., Allegheny, \$124,595.

Reese, Lindsay & Co., Allegheny, \$135,475.

A. Alston & Co., Allegheny, \$132,583.

Awarded to John Schirmer.

Cast-iron work.—Pennsylvania Construction Company, Pittsburgh, \$4,648. Awarded contract.

Union Foundry and Machine Co., \$6,366.

Fischer Foundry and Machine Co., \$4,870.

The building is to be finished July 1, 1888.

ALBANY, N. Y.—The following bids for a swing bridge and dredging Shinnecock and Peconic Bay Canal were received by James Shanahan, State Superintendent of Public Works, July 26: Ross & Sanford, New York, \$19,835.90; Frank Pidgeon Dredging Co., New York, \$15,737.85; S. V. R. Hendricks, Richville, N. Y., \$20,458. Awarded to Ross & Sanford.

GREEN BAY, WIS.—Bids for a draw-bridge over East River were opened by Council July 22, as follows:

Wrought Iron Bridge Company, Canton, O., \$5,630.

Milwaukee Bridge and Iron Company, one plan, \$4,700; one plan, \$5,000.

A. Y. Bain & Co., Minneapolis, Minn., \$5,470.

Wisconsin Bridge and Iron Company, Milwaukee, \$5,050.

F. E. Lane, Chicago, \$5,222.

King Iron Bridge Manufacturing Company, Cleveland, O., \$5,500.

One of the bids of the Milwaukee Bridge and Iron Company, the one of \$4,700, contemplated one less stringer than any of the others, allowing the sidewalk on each side to project over on the wooden sleepers.

NEW HAVEN, CONN.—At a meeting, July 25, the city and town joint board rescinded all contracts for constructing the county almshouse awarded under bids received a short time ago, and left the matter of new awards to a later meeting. We published the bids in a recent issue.

SCHENECTADY, N. Y.—The Supervisors opened bids, July 25, for the construction of a jail as follows: For a stone building, John McDermott, \$4,549; Andrew Kinnum, \$7,392. Mr. McDermott's bid for a brick and stone building was \$2,945, and Mr. Kinnum's, \$5,292.

The Westinghouse Company proposed to do the iron work for \$3,450, and William G. Caw's bid for the carpenter work was \$697. The contract for the mason work was awarded to John McDermott, he being the lowest bidder. The contract for the iron work was awarded to the Westinghouse Company, and that for the carpenter work to William G. Caw.

YOUNGSTOWN, O.—The following bids were received July 27 for paving Wick Avenue with fire-clay brick at Youngstown, Ohio (about 13,000 square yards):

Finch & Henderson, \$26,411.65.

Davis & Gore, \$30,905.10.

McElhaney & Walker, \$31,219.70.

The paving with brick, including concrete base, sand-ballasting, and filling joints with asphaltic mixture, per square yard, \$1.73.

PHILADELPHIA.—Contracts for the construction of six small cylinder boilers for the Gas Department, four for the Point Breeze Works, and two for the Manayunk Works, have been awarded to Sidebotham & Powell, at \$2,065. The other bidders were Henry Warden, \$2,475, and John Barzley \$2,475; also for 5,000 bushels of iron sponge to Connolly & Co. (Limited), the only bidders, at 44 cents a bushel.

Daniel McNicol was awarded the contract for excavating a cellar under the new City Hall, at 94 cents per cubic yard and the contract for the iron work to support the pavement over the cellar was awarded to the Phoenix Iron Company, of Trenton, at \$8,337.50.

MILWAUKEE, WIS.—Two contracts for street work were let by the Board of Public Works July 12. James Markey took the job of repaving Chicago Street from Broadway to East Water Street with stone blocks at \$2.60 per square yard. Chris Beck & Co. will grade and plank the sidewalks on Becker Street from Clinton Street to the Kinnickinnic River for 34 cents per lineal foot.

MONTREAL, CAN.—Bids for pumping apparatus (engines and boilers) for high-level service, Montreal Water-Works, received July 15: (Contract not yet awarded.) Blake Mfg. Co., Boston, \$12,080 and \$20,000; Holly Mfg. Co., Lockport, \$21,150; H. K. Worthington, New York, \$20,200; E. F. Gilbert & Sons, Montreal, \$22,500. The above bids were for engine to pump 2,000,000 gallons per 24 hours, a height of about 225 feet.

We referred to this matter last week.

GOVERNMENT WORK.

ABSTRACT of proposals for labor and materials for the erection of the Court-house at Fort Smith, Ark., entire building above concrete footings, opened July 25, by the Supervising Architect:

N. L. Wickwire, constructed in accordance with specifications, \$90,719; constructed with brick facing to basement walls, \$88,700.

Harris & Co., \$70,770; \$70,560.

Daniel A. Driscoll, \$82,435; \$80,980.

Daniel A. Driscoll with native bricks, \$77,837.

Bids opened by the Supervising Architect of the Treasury Department, July 27, for iron stairs for Post Office at Council Bluffs, Iowa, and for plaster and joiners' work for building at Concord, N. H., were both rejected, and new advertisements will issue for them.

SYNOPSIS of bids for iron, marble and slate-work of stairways for Post Office, etc., at Baltimore, Md., opened July 25 by the Supervising Architect:

Haugh, Ketcham & Co. Iron Works, \$44,950.

Poulson & Eger, \$58,000.

The Winslow Bros. & Co., \$49,500; with Concord Marble and with Red Tennessee Marble \$51,200 (informal).

PORTLAND, ME.—The following bids for removing ledge from Moose-a-Bec Bay were received by Major Jared A. Smith, U. S. Engineers, July 23:

George W. Townsend, Boston, Mass., \$24.83 per cubic yard, measured in place.

John F. Hamilton, Portland, Me., \$2 per cubic yard, measured in place.

Louis E. Lunt, Portland, Me., \$16.20 per cubic yard, measured in place. Acceptance recommended.

NEW YORK CITY.—Bids were opened at the Army Building on Thursday, July 28, by Deputy Quartermaster-General Henry C. Hodges for the masonry, iron work, and carpentry in the erection of a new gymnasium at West Point, N. Y. The following were the bidders:

Charles H. Bunn, New York City, masonry and iron work, \$26,822; carpentry, \$20,000; total, \$46,822.

James L. Lowry, New York City, for all, \$49,300.

John V. O'Rourke, Brooklyn, bid only on masonry and iron work, \$20,945.

MISCELLANEOUS.

YPSILANTI, Mich.—The town officials are preparing to convert an old cemetery into a park.

ALLEGHENY, PA.—Work has been commenced on the grand Penn Avenue entrance to the Allegheny Cemetery. The work will cost \$90,000.

ORLAND, CAL.—An irrigation canal is proposed.

FAIRPLAY, WIS.—A company of Eastern capitalists has purchased about thirty-five valuable mineral tracts lying between Fairplay and Shullsburg. The design is to sink a shaft 150 feet on the Burns place, in Smelser, and put in a steam-pump that will drain the surrounding country.

NEW YORK CITY.—New piers will be built on the site of "Screw Docks," recently bought by the city.

THE W. A. Fletcher Company of this city, has the contract for building the new steamer "Furitan" for the Fall River line.

DULUTH.—It seems probable that the new steamships for the Manitoba Railway Company will be soon built. Five steel steamers are contemplated to ship ore East via the lakes. It is learned that the new boats to be built by the Globe Iron Works for the Manitoba Company are to cost \$200,000 each. They are to be built after one model, 310 feet over all, 26 feet keel, 40 feet beam and 24 feet molded depth, with triple expansion engines; diameters of cylinders, 24, 38 and 60 inches, by 42 inches depth. Steam will be furnished by two boilers, each containing three turncases, and with a working pressure of 150 pounds. The steamers will carry 90,000 bushels of wheat, and when the line is completed it is reported that it will comprise twelve steamers and twelve consort. The costs of the consorts will be \$175,000 each, so that the whole line will cause an outlay of over \$4,600,000.

WASHINGTON, D. C.—The Secretary of the Navy will receive proposals, until November 1, for a torpedo boat; cost, \$90,000.

BUFFALO, N. Y.—The Businessmen's Association is organizing a company to develop the water-power of Niagara River for manufacturing purposes.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 10. } PUBLISHED EVERY SATURDAY.

NEW YORK, AUGUST 6, 1887.

LONDON, AUGUST 20, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

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Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 30, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

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THE MASSACHUSETTS INVESTIGATION OF WATER-SUPPLIES.

UNDER the provisions of an act of the Legislature, approved June 9, 1886, the State Board of Health of Massachusetts is charged with the oversight of all inland waters and water-supplies, with reference to their fitness for use or their liability to imperil the public health, and it is directed to cause examinations of the said waters to be made from time to time as it may deem expedient. To carry out this law the board has organized a system of investigation of the principal water-supplies of the State, which promises to be of great value, and the methods of which we commend to the attention of other State boards.

The first thing to be done is to obtain an exact account of the existing condition of the various public water-supplies of the State, and by this is meant, not the condition at a given hour or day, but the condition under different circumstances of temperature, season, storm, drought, or flood, etc. For this purpose the board has arranged to have samples of the different supplies forwarded each month throughout the year for analysis. Glass bottles of one gallon capacity are packed in open boxes and sent by express each month to the various towns and companies, with detailed instructions as to mode of collecting and forwarding samples. Arrangements have been made to have these samples chemically analyzed under the direction of Professor Drown, of the Massachusetts Institute of Technology, and by such a force that ten samples can be analyzed each day, so that all the public supplies in the State and the principal river-waters may be analyzed each month. Arrangements are also being made for expert biological investigations on the same waters. We print on another page the instructions for collecting samples and a copy of the certificate required with each sample. We also print the questions contained in a blank form circulated by the board to obtain information with regard to water-works throughout the State.

The results of an investigation thus conducted cannot fail to be of great interest and importance. No doubt the Board will take the necessary precautions to insure that the samples shall be what they purport to be, which must depend somewhat on the character and interests of those who gather them. Meantime we hope that the example thus set will be followed elsewhere, for there is no department of public hygiene in which we are in more need of a systematic, long-continued series of careful observations than in that of public water-supply.

IMPROVING THE NEW YORK CITY HALL.

MAYOR HEWITT, of New York, according to the *Evening Post*, has expressed some views in regard to the new public building which we should be sorry to see carried out. His plan, as reported, is to increase the room at the disposal of the city, not by the erection of a new building, but by additions to the City Hall, these additions to take the shape of wings and another story.

The building, with the exception of the north front, which is unfortunately of a different stone, is, architecturally speaking, the best of its kind in this country.

It is exceedingly well designed in a rather pure classic vein, and, with the exception of the Assay

Office, is about the only example of good work in that school in the country.

It is possible that lateral wings from the north-east and north-west corners, masking the unsightly brownstone, might be managed so as not to take away from the present excellent proportions of the Hall.

Even this, however, is highly problematical, as the proportion of length, breadth, and height in the present building is quite right. An additional story would ruin the only good example of its kind that we have. The building was designed as it stands, and is of such a character as not to admit of the superimposition of any kind of additional stories.

This fact, however, will probably have little weight with the powers that manage these things, since plans have been prepared for a mansard roof on the Custom-House, and an attic story was contemplated on the Sub-Treasury.

We have a good thing in the City Hall. Tampering with it will certainly not improve it and may work woeful injury.

MOUNT HOLLY'S WATER-SUPPLY.

THE town of Mount Holly, New Jersey, has experienced an outbreak of typhoid fever which began about the first of June, and has resulted in eighteen cases and four deaths. It is probable that the cause of this little epidemic was the pollution of the creek which supplies the town with water. The supposed source of pollution was the cesspool of a boarding-house three miles up the stream, in which boarding-house there were two or three cases of typhoid fever. The particulars of the outbreak have not been given with such detail as to make it possible to judge as to the probability of this theory; if it is correct the difficulty is to explain why more cases have not occurred.

This is, however, a matter of secondary importance. The fact that sewage has been discharged into the general water-supply of the town seems to be undoubted, and the folly of permitting this is the same whether it has thus far produced disease or not.

Is it still necessary that an outbreak of typhoid should occur to induce a town to look after the sources of possible contamination of its water-supply? How many towns are there in this country which keep up a careful and systematic inspection of their water-supplies in order to make sure that no sewage or other dangerous pollutions are discharged into them? We fear not many.

The water company of Mount Holly claims that it cannot be held responsible for the purity of the source from which it takes its supply, on the ground that it has no power to cleanse the stream. This plea is not a good or wise one. The company sells water; as a mere matter of commercial honesty it should furnish pure water, and it should know whether the water which it furnishes is contaminated or not.

It was the business of the water company, as well as of the authorities of Mount Holly, to know that there was a cesspool discharging into the stream, and if it had known it the pollution could have been easily stopped. The laws of New Jersey afford ample and prompt means for dealing with a nuisance of this kind; and in this case the carelessness and ignorance of those responsible for the condition of a public water-

supply have been brought to light. Let other town authorities and water companies take heed lest their shortcomings be also made unpleasantly conspicuous by a similar epidemic.

CONANICUT PARK FEVER OUTBREAK.

ANOTHER instance of criminal carelessness and ignorance has been brought to light in the matter of the drainage and water-supply of a summer resort—a condition of things for which the proprietors should be held pecuniarily responsible in damages for the sickness resulting, and criminally if fatal results ensue. Investigation at the Conanicut Park Hotel, near Providence, R. I., where an outbreak of fever resulted in an abandonment of the house by the guests, showed that the well was situated under the floor of a room adjoining the laundry; two earthen drains, with the usual leaky joints, passed within a few feet of this well, making a junction just beyond it, so that the well, with considerable ingenuity, was located just within the angle, in order that every possible facility might be af-

tified to by State health authorities, should be required by law to be conspicuously posted in each summer resort. There is now sufficient intelligence in these matters outside the keepers of such establishments to detect and cause the correction of any serious defects; publicity, therefore, would be an effective safeguard.

It is quite as important in these days that such information should be posted for the information of the public as that certificates of boiler inspections should be displayed on all steam vessels. Indeed, we believe polluted water destroys more lives than steam-boiler explosions.

PROVIDENCE SEWAGE DISPOSAL.

THE City Council of Providence has at last passed a resolution adopting the plan for the improved disposal of sewage and purification of the river and Cove proposed by the City Engineer, Mr. Samuel M. Gray, whose report on the subject was duly noticed in THE SANITARY ENGINEER AND CONSTRUCTION RECORD. The essential features of the plan are the collection

been lodged in jail on a charge of swindling, together with some people of his staff. The railway companies have kept aloof from the undertaking, and confidence in it has been lacking. To what extent American firms have exhibited we do not know, though we apprehend the main losers in the undertaking will be the contractors who put up the buildings.

A BILL has been brought into Parliament by Mr. Elton, entitled "A bill to provide for the registration and regulation of vans and other vehicles used as temporary dwellings," the essential feature of which is that the Local Government Board are to prepare regulations for registering such vehicles, for fixing the number, age, and sex of the people who may be allowed to dwell in each, and for promoting the cleanliness of and preventing the spread of infection by such vehicles.

It is a curious bit of legislation, and the fact that it should be considered as necessary in England will some day be commented on by the historian.



A RESIDENCE NEAR PHILADELPHIA, PA.—GEORGE T. PEARSON, ARCHITECT.

fording for its receiving the contents of these leaky drains, as will be seen by the sketch elsewhere in this issue. A removal of the floor revealed a mass of filth from the drains running into the well. Of course, the business of this hotel for this season is practically killed. The question, however, which is of importance, now is, How many other summer resorts have their wells or drinking-water cisterns in close proximity to drains now defective or likely to become so?

The Providence *Journal* says the Rhode Island State Board of Health has no funds to enable it to make the necessary inspections of such resorts. If this is true, it is to be hoped that such will not be the case another year, and as a measure of protection every State Board of Health should endeavor to secure legislative authority and funds to make such inspections, and also to prepare a plan showing the drainage system of all summer hotels, including location of wells, cisterns, and cesspools, all to be drawn to a scale. A copy of this plan, cer-

of the sewage at Field's point below the city, the level of delivery being 14 feet below high water; the raising the sewage of this point by pumping works to a height of about 28 feet; its treatment by a chemical process in precipitation tanks, and the discharge of the purified effluent into the river. It is to be presumed that the work will be commenced at once, and every one who knows the condition of the river in the city will certainly agree that it is full time that something was done to mitigate the dangerous nuisance which it now presents. We congratulate Mr. Gray on the endorsement thus given to his plans, and trust that he may have the pleasure in due time of carrying them out to completion.

THE PARIS RAILWAY APPLIANCE EXHIBITION FIZZLE.

ADVICES from Paris inform us that the International Exhibition of Railway Appliances is likely to prove a disastrous failure, if that result has not already been reached. We are informed that the promoter of the enterprise has

OUR SPECIAL ILLUSTRATION.

RESIDENCE OF C. W. NORTON, ALLSTON, MASS.

OUR special illustration is of the residence of Mr. C. W. Norton, at Allston, near Boston. It is of wood, stained shingles on walls and roof. In interior oak and stained ash, and stained white wood. Carved brick fire-place in library. This room fitted up with cases. Library hall and parlor ceiling finished with wooden ribs. Good quality colored glass in staircase windows. Cost, about \$16,000. Messrs. Hartwell & Richardson, of Boston, are the architects.

OUR VIGNETTE ILLUSTRATION.

THE subject of our vignette illustration this week shows a residence near Philadelphia, of which George T. Pearson is the architect.

OUR DETAIL SHEET.

OUR detail sheet this week shows a sketch of a summer house on the old Craddock estate, Medford, Mass. Architect unknown.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF C. W. NORTON, ALSTON, MASS.

HARTWELL & RICHARDSON, BOSTON, ARCHITECTS.

Old Craddock Estate

Medford

Mass.

Scales --
Elevation 1" = 2' 6"
Details 1" = 6'

Tinned

Belvidere

Shingled

A

B

C

Bricks

arms off
figure of Mercury
wing

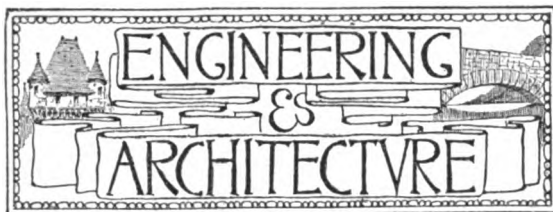
Sketch

Detail A

Detail B

Detail C

Measured and drawn for
The Sanitary Engineer and Construction Record



MODERN SEWER CONSTRUCTION AND SEWAGE DISPOSAL.

BY EDWARD S. PHILBRICK, MEM. AM. SOC. C. E.

No. VII.

(Continued from page 68.)

THE capacity of the Boston Main Drainage Works was based upon the following considerations. The whole area to be drained in the future within the basins of the Charles and Neponset rivers comprises about fifty-eight square miles. Of this area some forty six square miles might hereafter be drained by a high-level sewer, leaving some twelve square miles to be tributary to the low-level system, the construction of which was immediately called for. As the high-level sewer might not be needed for a considerable time, and in the meantime certain sections naturally tributary to it might be temporarily drained into the low-level system, an area of twenty square miles was assumed as that to be now provided for.

The population was assumed as $62\frac{1}{2}$ persons to the acre, making 800,000 in all, tributary to the main sewer. But in adjusting the sizes of the several intercepting sewers, branches of the main, a greater density of population was provided for than the above average. Seventy-five gallons, or ten cubic feet per day, was assumed to be contributed by each person. Since, during the day time, the flow is always greater than the average, the maximum flow was taken at one and a half times the average. These data give about 139 cubic feet per second of sewage to be provided for. To this was added 100 cubic feet per second of rain-water, to be admitted in time of storms, which would amount to somewhat less than one-fourth of an inch of rainfall per hour from the tributary surface. The sizes and inclinations of the several intercepting sewers were adjusted for carrying the above volumes of water and sewage while running half full.

This plan of using only one-half the capacity of the conduits by the maximum flow may at first appear extravagant, but good reasons appear for such provision—viz.: If the same sewers had been constructed of such size as to run full with the maximum flow, although they would have required much less material, the vertical depth of the flowing streams would have been some three feet more than under the conditions adopted, while the lateral expansion would have been correspondingly less. Such a plan would, therefore, have required an average of three feet greater depth of excavation, and three feet more lift at the pumps, while providing much less storage capacity in the sewers themselves for equalizing the duty of the pumps in time of storms, and avoiding the gorging of the conduits in the low-level districts after heavy rains.

The assumption of one-fourth of an inch per hour as the quantity of rain-water to be admitted was, of course, an arbitrary one, and taken merely as an average. The low-level districts must at times contribute much more than this, while the hill districts need not contribute any more storm-water than it is found convenient to receive, for the surplus can be allowed to discharge into the harbor through the old openings to any extent which experience shows to be advisable. After the first rush of rain-water has rinsed the streets in a violent rain-storm the flow from that source is comparatively harmless if allowed to flow into the harbor. This first rush from the hilly districts would have entered the main sewer and become partially distributed along its course before any great volume could have accumulated from the lower levels where the flow is more sluggish. As the apparatus devised and constructed to govern the admission of storm-water from the laterals into the intercepting sewer is generally automatically self-governing, depending upon the actual depth of water in the intercepting sewer at the time, and as the quantity of rain-water to be admitted at any point under any given level of water in the intercepting sewer is capable of change and adjustment to suit such circumstances as may arise from time to time, the admission of rain-water in any considerable quantity is evidently subject to detailed control, and need not be a subject of embarrassment for a long time to come if at all.

The lateral sewers which had been recently constructed

in the streets all about the city had been proportioned to carry a flow of rain-water of one inch per hour from the tributary surface. Although copious rains are on record in this neighborhood showing a rate of rainfall as high as two inches per hour for short periods, they seldom, if ever, continue at that rate for more than thirty minutes, or an hour at most, while the obstacles existing on the surface, even in paved streets, prevent the water from getting into the sewers at such times as rapidly as it falls. In fact, a considerable accumulation always occurs on the surfaces and along the gullies, which drains off after the fall from the clouds becomes more moderate, and without serious inconvenience.

Among the problems peculiar to the locality, which were presented in connection with the construction of the Boston intercepting sewers, was the following.

Considerable anxiety had been felt, and with a reasonable justification, that the level of the ground-water would be lowered throughout that part of the city which had been reclaimed from tidal flowage, consequent upon the construction of a system of sewers some twelve feet to eighteen feet below those formerly existing. That part of the city was all built upon spruce piles driven into the mud, and their tops had been cut off at a level of some five feet or more above low water.

If the ground-water should be permanently drained to a level below these pile-heads, they would be exposed to air which would enter the pores of the soil previously occupied by such water, and the piles would be subject to decay, endangering the stability of all the structures resting on them. In order to settle the question beyond a reasonable doubt, the following experiment was tried: A steam-pump was set at work in one of the largest of the old sewers—viz., in Berkeley Street—near its mouth, to keep the sewer nearly empty throughout all stages of the tides, as it would be after the construction of the proposed intercepting sewer. Previous to starting this pump twenty pipes were driven into the soil in the neighborhood, some close to the sewer, others at a few hundred feet distance and still others more remote. The level of the ground-water was carefully noted in these pipes before pumping and twice a day during the experiment. The result is interesting, and is thus stated by Mr. Clarke: "It was found that the surface of the soil-water was nearly level over the whole Back Bay district, averaging $7\frac{1}{2}$ feet above mean low water, and its height, while slightly affected by local contours of the surface, was independent of the sewers in its vicinity. For instance, the water in the vicinity of the Dartmouth Street sewer was at the same level as that near the Berkeley Street sewer, although the latter sewer is two feet lower than the former. Also, it was found that the soil water rose and fell, responding quickly to any rain or melting of snow (the extreme rise due to four inches of surface-water being one foot), and that the variation was nearly uniform over the entire district. Finally, it appeared that the pumping, which continued fifty-three days, affected but slightly, and that only within one hundred feet of the sewer, the soil-water in the vicinity of Berkeley Street. At the close of the experiment, the sewer resuming its former conditions, the soil-water in its immediate vicinity rose from an inch to an inch and one-half, and thereafter fluctuated in union with the water in other localities."

The results here recorded might have been quite different if the sewer in Berkeley Street had been less thoroughly constructed. It is well known that some brick conduits have acted as ground-drains to a considerable extent. The experiment above quoted shows conclusively that where proper precautions are taken in the choice of materials and the character of the workmanship, the ground-water can be practically excluded from such structures.

I think the Boston system, which I have now described pretty thoroughly (except as to its pumping and delivery apparatus) exemplifies pretty well how a separate and combined system can be combined, so to speak—i. e., how it can work for sewage and rain-water combined up to the limit of its capacity, and then discharge its surplus at convenient points, subject to automatic control, and still give satisfactory results.

Whenever the city shall grow in the future to a point when the capacity of the present system will be fully needed for sewage alone in any one or more districts, then the system provides for the overflow of the rain-water, so that the intercepting sewers and all the new works constructed for the ultimate disposal of the sewage will be unencumbered with rain-water, except such as may come from the small area where the grade of the streets is very low, and even there the grade may eventually be raised. Each district then will have a combined system of sewerage for the collection of the sewage as well as rain-water, while these will be separately disposed of as a general rule in all heavy rains.

(TO BE CONTINUED)

THE DRIVEN WELL SYSTEM AS A SOURCE OF OR A MEANS OF OBTAINING A WATER-SUPPLY.*

IN considering the question of the value of the driven well system as a source of or a means of obtaining a water-supply, one has to practically consider the whole question of ground-water or subterranean supply as obtained by driven, bored, artesian, or open wells, for the general laws governing each are substantially the same, and by various modifications they often operate together. Thus a driven well by passing through an impervious stratum becomes an artesian or flowing well, or an artesian well may, by the driving of other wells, cease to flow, and then be called open or driven. The definition of a driven well is commonly given as one formed by driving or forcing a wrought-iron or galvanized-iron tube down into the stratum from which the water is to be taken. These pipes are generally from $1\frac{1}{2}$ inches to 8 inches diameter, and may or may not be furnished at the lower end with a wrought-iron or steel point. Above this point, the pipes are perforated for some distance with holes to admit the water.

"It is claimed that Nelson W. Greene, a colonel of New York volunteers in the late war, to give the men of his command pure water, devised in his own mind a method by which this could be done, and a test was successfully made in 1861 on the fairground at Courtland, N. Y., at the expense of one Graham, who had a contract to supply food and other necessary articles to the soldiers in camp there.

"This well was used generally by the men in camp and by Graham and his employees. In 1868, Greene procured a patent for this invention, and in 1871 had a reissue thereof, in which he claimed as his invention the creation of a vacuum in the lining of the well for the purpose of using the pressure of the atmosphere to bring up the water."

The claim was also made and allowed for the construction of a tube well without the removal of the material.

The issuing of this patent has been the source of a large number of lawsuits, and the payment of large sums of money as royalty by individuals and corporations when the sum at stake would not warrant a suit.

In the suit *Andrew vs. Hovey*, brought in the United States Circuit Court for the Northern District of Iowa, it was shown that in 1851, in Independence, Mo., a tube was driven in the water-bearing stratum, and by a pump attached to the tube, water was drawn through it, apparently in inexhaustible quantity.

It was further shown that in 1849 and 1850, E. W. Purdy, a well-maker in Milwaukee, Wis., drove a number of these wells, some of them to the depth of sixty to one hundred feet. Another case in our neighborhood has come to my notice, wherein driven wells of this character were in use previous to its inception by Col. Greene, the details of which may be of interest to the association.

Calvin Horton, of East Somerville, Mass., was employed in 1851 in putting in deep-well pumps. His attention was called to an open well which had become filled up with sand and yet a free flow of water could be raised with the pump, about the end of the suction of which a metallic gauze had been wound. This led to the question of the necessity of constructing open wells. In order to test its practicability, he claimed that in June, 1859, he drove a wrought-iron pipe one and one-half inches in diameter, with one end perforated with small holes for a distance of about two feet. In order more readily to drive this in, and to protect the perforations from injury in the passage of the pipe through the ground, he had a wrought-iron point and sleeve made, extending from the end of the pipe to a point above the perforations. The pipe was driven by inserting an iron drive-rod inside of the pipe and resting on the bottom of the sleeve or point. The pipe was driven through twenty-eight feet of clay into a stratum of sand and sea-washed gravel, making a total length of thirty-six feet. The point and sleeve was then driven ahead of, or away from the pipe. Upon attaching a pump to the pipe and cleaning the end of the pipe from fine sand which had washed in, he obtained a free flowing well, yielding, at a point three feet above the surface of the ground, eighty-five barrels of water in twenty-four hours. The water rose in the pipe to the height of seven feet above the ground. Early in the year 1861, he claims to have put in his first driven well for which he received

* A paper by Albert F. Noyes, City Engineer, Newton, Mass., published in the Journal of the New England Water-Works Association for June, 1887.

compensation. It was put in for Charles Linehan, of Cambridge, and was located on land about ten feet lower in level and three-fourths of a mile distant from the first well, and upon ground about six feet above high-tide level. The tube was sixty-seven feet deep, and was driven through fifty-four feet of marsh-mud and clay and into a stratum of sand and gravel. The water flowed freely from the well, a pump was attached to it, and the water was used for domestic purposes.

It may be of interest to note here that the draft upon the second well caused the flow from the first to cease, but upon the cutting off of the pipe of the first well to a point within eighteen inches of the ground, the flow was restored.

Early in 1863, Mr. Horton put in a 2-inch tube well for Burr Brown at the Hingham Dye House. This well was forced through a yellow, clayey quicksand about forty feet, and into and through about eight feet of gravel, and furnished, by constant pumping, about ten thousand gallons of water per twenty-four hours.

In 1876, the well being insufficient for the increased demand upon it, two more tubes were put down. They were ganged to or connected to the first, and the three were connected by a 2½-inch suction-pipe to a steam-pump. The yield from these wells continues substantially as when first put down, and, with the exception of the first well, they are in continual use to-day.

The introduction of water for the public supply rendered the first well of but little value, and it was recently connected with the public sewer, and when last seen was flowing as at first.

During the years 1865 and 1867, he put down a number of wells for the Boston and Fitchburg Railroad; at the Brighton cattle-yards a series of seven 1½-inch tubes were put down thirty feet deep and connected. At the Union cattle-yards, at Watertown, a set of nine 1½-inch tubes was driven in the gravel and sand deposit twenty-seven to thirty feet deep. These were later connected with eighteen additional 1½-inch tubes, and connected by a 4-inch suction-pipe with a steam-pump.

The Shaw patent, so-called, for ganging of driven wells was issued in April, 1870, but from the above it would seem that the scheme had been in public use some years previous.

Over 150 patents have been allowed upon various devices for well points to prevent the inflowing of the finer material into the well. As they consist for the most part in devices or ideas for attaching fine wire or perforated gauze about the perforated pipe, it seems to me they can be of but little permanent value, the space between them and the pipe soon filling up with rust, and these well points with outside covering are, so far as I can learn, the only cause of diminished yield, other than that caused by the driving of additional pipes within the area influenced by the well. Better results are usually obtained by driving an opened end pipe having attached at its lower end a steel shoe similar to a common pipe-coupling. This is first forced into the ground and a small hollow rod or pipe, to which a steel point is welded, has small holes drilled into it, so that a jet of water forced into the rod will discharge into the holes and play on the point of the drill. This loosens the material about the point of the tube and a large part is forced, by overflow, out from the pipe. The wash-pipe is then removed, the tube driven until checked by the resistance of the earth, when the process of cleaning out is renewed until the level from which it is desired to take the water is reached.

When a number of water-bearing strata of coarse material are encountered, additional pieces of perforated pipe may be advantageously inserted, thus materially increasing the yield, and diminishing the velocity of the water flowing into the pipe at any one point, thus preventing a tendency towards an inflowing of the finer material.

Precaution should be taken, where a number of pipes are to be connected, not to place any of the perforated pipes at a level above that affected by the suction from the pump, this level limiting the depth or level from which the ground water can be drawn.

Where it is desired to determine the character of the strata through which the pipe is being driven, a sand-pump may be used with better results than with the driving-rod.

This is usually a metallic cylinder of a little less diameter than the inside of the bore of the well-tube, having a clap-valve at one end and a handle at the other which acts as a guide to a rod to which is attached a washer closely

fitting the inside of the cylinder. The rod is worked up and down, acting as a suction-rod to a pump, thus filling the cylinder or pump with the material which is withdrawn. The process is continued until the well is cleaned out; after this the driving continues.

The driving of small tubes is usually effected by sledges striking upon an iron-bound wooden block, or by a small, portable pile-driver, or by a weight or monkey running over a portion of the tube and striking against an iron clamp. This weight may be raised by a rope passing over a sheave or sheaves attached to a tripod, or clamped to the upper portion of the tube.

The larger tubes are driven by pile-drivers with large, heavy, wooden hammers attached to a rope which passes over a sheave at the top of a high derrick and operated with steam-power.

In driving, great care must be taken to keep the joints of the pipe well screwed up, for the jar, from driving, has a constant tendency to unscrew the sections of the pipe.

A process has recently come to my attention for clearing the well-tubes, known as the Wagner Steamed Well Process, and is a substitute for the water-jet process. The excavation and the removal of the material is effected by the injection of a jet of steam, under a high pressure, at the end of the well-tube. It is stated that all of the finer material is forced out from about the tube, and that the cleansing power of the steam is greater than that by the water-jet, and its influence is felt at a greater distance than by any other process. It is also claimed that excavations have shown all of the finer material to have been washed out for a distance of at least twelve feet.

In order to fully determine the relative value of the two methods of well-driving, five wells have been driven at Franklin, Ohio, with a light pile-driver and sand-bucketed in the usual manner, and one well by the steamed-well process, and each of the wells is to be tested separately.

It might be well to consider here the source from which wells derive their supply and the natural laws governing them. It will undoubtedly be conceded by all that the source of all water-supply is primarily that derived from the clouds or atmosphere, in the shape of rain or snow, a portion of which sinks into the earth, and where the surface deposit is gravel, or other porous material, overlying some impervious stratum or rock, the water collects and constitutes the ground-water of the locality. J. T. Fanning, in his treatise on water-supply engineering, says: "Respecting the porosity and absorptive qualities of different earths, it may be observed that clean silicious sand, when thrown loosely together, has voids between its particles equal to nearly one-third its volume of cubical measure; that is, if a tank of one cubic yard capacity is filled with quartzoid sand, then from thirty to thirty-five per cent. of a cubic yard of water can be poured into the tank with the sand without overflowing.

"Gravel, consisting of small water-worn stones or pebbles, intermixed with grains of sand, has ordinarily twenty to twenty-five per cent. of voids.

"Marl, consisting of limestone grains, clay, and silicious sands, has from ten to twenty per cent. of voids, according to the proportions and thoroughness of admixture of its constituents.

"Pure clays have innumerable interstices, not easily measured, but capable of absorbing, after thorough drying, from eight to fifteen per cent. of an equal volume of water.

"The water contained in clays is so fully subject to laws of molecular attraction, owing to the minuteness of the individual interstices, that great pressure is required to give it appreciable flow.

"Water flows with some degree of freedom through sandstones, limestones, and chalks, according to their textures, and they are capable of absorbing from ten to twenty per cent. of their equal volumes of water.

"The primary and secondary formations, according to geological classification, as for instance, granites, serpentine, trapeans, gneisses, micascates, and argillaceous schists, are classed as impervious rocks, as are, usually, the several strata of pure clays that have been subjected to great superincumbent weight.

"The crevices in the impervious rocks, resulting from rupture, however, gather and lead away, as natural drains, large volumes of the water of percolation.

"The free flow of the percolating water toward wells or springs, is limited and controlled, not only by the porosity of the strata which it enters, but also by their inclination, curvature, and continuous extent, and by the imperviousness of the underlying stratum, or plutonic rock."

It is estimated that in a free, open soil, above one fourth of the rainfall percolates into or is absorbed in the ground, and the balance is taken up and evaporated by vegetation, or flows off over the surface to the streams and ponds. As the laws of gravity govern the flow of water through the soil in the same way as in streams, retarded only by the frictional resistance of the material through which it passes, the more compact the material the greater head required to force itself to an outlet, hence the reason for the great difference in the level of the ground water, even in localities of small area.

(TO BE CONTINUED.)

ARCHITECTURAL LEAGUE OF NEW YORK.

MESSRS. F. A. WRIGHT, E. H. Clark, and John P. Riley, on behalf of the Committee on Current Work, have issued the following circular:

The programme for the second midsummer outing has been arranged as follows:

Leave New York August 18 by Fall River boat at 6:15 P. M. for Newport. In the early morning, after coffee, there will be a trip to the beach in carriages, which will be at the service of the party all day. After a bath in the surf, breakfast will be taken at the Aquidneck. The balance of the morning will be spent in a drive to some of the best houses in Newport, and an examination of the interiors of a few of them, including Mr. Cornelius Vanderbilt's and Mr. Robert Goelet's houses. Lunch will be had at the Casino, and the party will take the afternoon train for Boston. The headquarters in Boston will be at the Parker House, the dinner there on the evening of the 19th being a regular League dinner. On this occasion, beside the Boston members of the League, there will be present invited guests from the leading members of the profession in Boston. On the morning of the 20th there will be a drive around Boston and out to Brookline, with inspection of noted exteriors and interiors. About noon the party will take train to North Easton, where all the famous Richardson buildings, including the Ames gate lodge, will be inspected from without and within, through the courtesy of Mr. Ames. The return to New York will be by Fall River boat on the evening of the 20th.

The entire necessary expenses of the trip to each member, including passage both ways, staterooms, hotel bills, carriage hire, all meals, etc., will be in the neighborhood of twenty-five dollars.

In order that the committee may conclude proper arrangements it is absolutely necessary that acceptances for the above trip should be received by F. A. Wright, 140 Broadway, New York, on or before August 9.

Charles I. Berg, 152 Fifth Avenue, New York, is secretary of the League.

The third annual exhibition of architectural drawings, under the auspices of the Architectural League, will be given in the new Ortgies' Gallery, Fifth Avenue, next the A. T. Stewart house, during the last two weeks of December and the first week in January.

It is the purpose of the League to make this year's exhibition much more complete than any former one.

In furtherance of this it is proposed to set aside rooms for the exhibition of the allied arts—viz., sculpture and decorative painting, stained glass, textile fabrics, embroidery, etc. It is designed that the exhibition shall represent, as far as possible, work of the current year.

The first announcement of the League will be issued in a few days and will be followed by a prospectus stating the kind and class of work that will be received, the name of the jurors, and other information for intending exhibitors.

The twenty-first annual convention of the American Institute of Architects will meet in Chicago on October 19, 1887. The Committee of Arrangements is A. J. Bloor, W. L. B. Jenney, E. H. Littell, and Henry Lord Gay.

THE NEWARK, N. J., SEWERAGE SCHEME.

MESSRS. A. FTELEY and W. E. Worthen, the engineers who were engaged by the Sewer Committee of the Common Council of Newark, N. J., to examine and report on the intercepting sewer recently constructed, have made a lengthy report in which they state that "the system of sewerage, as far as constructed, has been well carried out, works successfully, and will, when properly connected with the old sewers, abate the nuisance created by their discharge on the meadows."

A full illustrated description of this important work appeared in the issues of THE SANITARY ENGINEER and CONSTRUCTION RECORD, dated May 7 and 14, pages 600 and 628, Volume XV.

The Joseph Weiss electro-motor has been applied to the Jersey City and Bergen Horse Railroad.

The Common Council of Milwaukee have finally determined to dispose of the garbage of the city by cremation, which is a sensible decision under the circumstances.

PAVEMENTS AND STREET RAILROADS.

No. IX.

(Continued from page 236.)

ASPHALT AND CONCRETE FOOT-PAVEMENTS.*

THE object of this paper is to draw the criticism of the members of the association upon the experiments and experience of the writer and others, on asphalt and concrete as materials for foot-pavements, and, if possible, to induce others to carry forward experiments with a view to perfecting the use of these pavements.

The writer desires to place in the forefront of the paper the fact that the credit of the Hornsey experiments herein referred to is due to Mr. T. de Courcey Meade, A. M. I. C. E., who most readily placed them at the disposal of the writer for this paper; and also his obligations to the French Asphalt Company, the Val de Travers Asphalt Company, the Imperial Stone Company, and others, for the information given. Every pavement described has been personally examined by the writer, and the exact locality of each is stated, so that any one may examine them for his own information.

Asphalt, properly so called, is a natural compound of carbonate of lime and bitumen, and is found principally in volcanic areas. Men of erudition have asserted that it was the "pitch" used to make the Ark watertight, and that it was the "slime" used as a mortar in the construction of the Tower of Babel and the city of Babylon. If such ancient uses of this substance are facts, its virtues were strangely lost sight of in the intervening centuries, for it is not till 1700, A. D., that its use became common. It was then used for the purpose of extracting "balm" from its beds, which was used for medical purposes and was credited with superior healing powers. The origin of the asphalt beds has given rise to much speculation. A Swiss geologist has made an effort to explain their formation in a striking manner. Starting from the observation that all organic matter exudes bitumen in decomposing, he suggests that the beds are the remains of huge banks of oysters, the shells of which furnished the carbonate of lime, and the oysters themselves furnished the bitumen. As the asphalt beds are in some cases 27 feet thick, and their areas are measured by square miles, it is evident that oysters were plentiful in those days.

The works of the French Asphalt Company are described, as that company has executed all the asphalt works in Chelsea; but the writer wishes to say that the Val de Travers Company, Claridge's Asphalt Company, and others do equally good work.

The mines of the French Asphalt Company, from which their English supply of asphalt is obtained, are situated at St. Ambroix, in the south of France. The asphalt is in seams, which lie nearly horizontal, and which have their faults, bends, etc., like coal seams. The bed and roof of the seams are of pure carbonate of lime rock, presumably the same as that of which the asphalt is largely composed. The seams vary from three to five feet in thickness, and are worked by drifts from the outcrop on the hillside. The rock is mined by blasting and hand labor, and comes from the drifts in pieces measuring one cubic foot and downwards. The asphalt then has a very dark chocolate color, and appears to be a tough homogeneous substance, with striations of white matter running through it parallel to its natural bed, which are probably narrow seams of carbonate of lime. When it is exposed to a hot sun the surface will glisten with small fatty beads of bitumen, but at ordinary temperatures it is dry. After exposure to the air the surface turns a dull white color, owing to the evaporation of the bitumen; but this change is only skin deep. The rock is conveyed to Marseilles just as it leaves the mine, and is shipped to England. Formerly the beds of asphalt yielded a supply of natural bitumen, but twenty years ago the supply ceased, owing, it is believed, to some widespread cause, as several mines were affected in the same way at that time.

At the depot of the company at Stratford, the rock as delivered by ship is passed through a crusher which acts like a Blake's crusher, save that the solid jaw is replaced by a series of knives, and by which it is reduced to pieces not exceeding three inches in length. The pieces are poured into a Carr's disintegrator, which has spindles revolving 800 times a minute in opposite directions, and which reduces the asphalt to powder. The powder is screened through a rotary cylindrical sieve (144 to the square inch) and is then stored in sacks. The asphalt varies in the proportion of bitumen it contains. The richer parts are ground and stored separately from the other, and are afterwards mixed in suitable proportions for the particular use to which they are to be applied.

The following are analyses of asphalt rock of average richness at this stage:

	No. 1 Sample.	No. 2 Sample.	Average.
Bitumen.....	10.70	10.60	10.65
Carbonate of lime.....	88.05	88.15	88.10
Silica.....	0.55	0.40	0.48
Alumina.....	0.10	0.15	0.12
Peroxide of iron.....	0.20	0.10	0.15
Moisture.....	0.40	0.60	0.50
	100.00	100.00	100.00

* A paper by George R. Strachan, A. M., Inst. C. E., of Chelsea, London, S. W., read at the annual meeting of the Association of Municipal and Sanitary Engineers at Leicester, July, 1887.

When the asphalt is about to be used, the powder is poured into revolving roasters, and roasted for three hours at a temperature of 280° Fah., during which operation the moisture is driven off. As the asphalt chars at 320° Fah., care has to be exercised as to the proper temperature. It is loaded direct from the roasters into carts lined with sheet-iron, covered with hemp cloths, and thus protected it retains its heat till it is taken to the site where it has to be laid. It is carried from the carts in baskets, spread over the foundation by means of a rake and rammed solid by a series of blows from heavy heated rammers. The surface is ironed by a heated iron, which draws bitumen to the top, and in a few hours it is ready for traffic. This form of asphalt is known as compressed asphalt, and is the form always used for carriage-ways and frequently for footways.

The other form of asphalt is known as mastic asphalt, and is a manufactured compound made up of natural asphalt, artificial bitumen, and grit. The asphalt is reduced to a powder as described. The artificial bitumen is used because of the scanty supply of natural bitumen. Its principal component is Trinidad pitch, to which is added from five to seven per cent. of shale oil. The mixture is boiled for twenty-four hours; the top liquid is ladled out, and is the artificial bitumen. It is a soft, viscous, black substance which softens under the sun's rays. Its quality is tested by taking a piece between the fingers and drawing it out to a string; if it does not snap until drawn out very fine it is of good quality. The grit is obtained from Bridport, is wholly composed of flint, very clean, and the pieces do not exceed $\frac{1}{8}$ -inch in size. The mastic asphalt is prepared as follows: From five to seven per cent. of artificial bitumen, from 20 to 30 per cent. of grit, and the balance in powdered asphalt are placed in a covered caldron and heated for four or five hours. The mixture liquefies at 280° Fah. to 300° Fah. If it is to be used near the works (within 10 miles), it is run into locomobiles (boilers on wheels), with a fire under them, and drawn to the site. When it is used, it should be hot enough to vaporize a drop of water. It is carried in pails and spread over the foundation by means of a float. Silver sand is then spread sparingly over the surface and rubbed in by floats. In six hours the footway is ready for traffic. One ton of asphalt covers 20 square yards when laid one inch thick.

When mastic asphalt is to be laid at a distance from the works instead of running it from the caldrons into the locomobiles, it is run into molds, and molded into flat cylindrical pieces weighing about 56 pounds each. These are taken to the site, placed in a caldron, from 3 to 4 per cent. of additional bitumen added to make up for the loss by evaporation, and heat applied to reduce it to a liquid condition. The laying is then performed in the same manner as before described.

This description may be taken as applicable to the method adopted by the Val de Travers Company, with a few variations in the proportions used. The following analyses of asphalts are of interest, as they are those of rocks of average richness:

	Val de Travers Co.	French Asphalt Co.
Bitumen.....	9.75	10.65
Carbonate of lime, etc.	89.75	88.85
Moisture.....	.50	.50
	100.00	100.00

The following analyses, in a different form, were placed at the writer's disposal by Mr. Meade:

	VAL DE TRAVERS.		FRENCH ASPHALT CO.	
	Rock.	From Cheap-side.	From Hornsey Lane.	From Crescent Road.
Silica.....	0.6	0.5	0.3	0.4
Volatile organic matters (tar, oils, etc.).....	5.8	5.8	6.5	6.0
Non-volatile organic matters.....	13.0	9.8	13.6	16.9
Lime, etc.....	80.6	83.9	79.6	76.7
	100.0	100.0	100.0	100.0

This detailed description and the numerous analyses of good asphalts have been given, so that spurious asphalts may be avoided.

In Chelsea there are 16½ miles of footways paved with mastic asphalt, having an area of 68,290 square yards. On the Queen's Park Estate there are 41,500 square yards, which have been laid five years, and which are now in good condition, not having cost one penny for repairs. In King's Road, at Walpole Street, a length has been laid for seven years. The foot traffic over it is 7,500 persons in eighteen hours. At the end of the first five years it was cut open, and the wear was found to be such as had reduced the thickness to a spare $\frac{1}{4}$ of an inch, the original thickness being $\frac{3}{4}$ inch full. On the east side of New Bond Street a length of mastic asphalt was laid thirteen years ago between Oxford Street and Conduit Street, the thickness being $\frac{3}{4}$ of an inch. The asphalt is now wearing through on to the concrete in the line of traffic at the forecourt line. The cost for repairs has been so trifling that it may be neg-

lected. In this case the concrete foundation is as sound as before, and all that is necessary to restore the footway is to relay the asphalt at about two-thirds of the original cost, when the pavement will be good for another thirteen years. As the traffic here is very severe and the footway narrow, it is reliable evidence of the durability of asphalt.

The foundation for the asphalt footway is made with 3 inches of Portland cement concrete (6 to 1) of very good quality. The surface is smoothed with the shovel, and four days are allowed for drying. The concrete has been laid hitherto without any joints. The mastic asphalt is floated over the surface, and the path is then completed. Mastic asphalt does not show any cracks on the surface. The concrete foundation, when the asphalt is removed, shows the irregular, tree-like cracks all along its length, branching from the kerb to the back line, but the elasticity of the mastic asphalt is sufficient to resist the tearing action of the concrete as it contracts.

A study of the asphalt question resolves itself principally into a study of the movements of concrete when laid in long lengths, narrow widths, and small thicknesses. The writer inclines to the opinion that concrete has in itself a small power of contraction, apart from any considerations of temperature. The experiments of Dyckerhoff, which show that neat cement (slow setting) had an average expansive power over twelve months of .0734 per cent., and quick-setting cements of .2019 per cent., and that concrete (3 to 1, sand) had an expansive power of .0264 per cent. (slow-setting) and .0320 per cent. (quick-setting), seem to show the contrary to be the case. The writer laid down a length of concrete (6 to 1, ballast) 52 feet long, 12 inches wide and 3 inches thick, under a shed which had an open front, but so that the sun did not touch the concrete. The strip was laid on sand so as to give it freedom of movement. Another strip 26 feet long, of the same width and thickness (3 to 1, pebbles), and a third of the same dimensions (3 to 1, sand) were also laid under the same conditions. The only movement discernible, at the end of one month, was a slight contraction in length in all the samples. The uniform experience of concretes under asphalt is that cracks occur, which would tend to show that contraction and not expansion is the rule. At the same time, the writer has experience that concretes do expand, but this he attributes to the action of temperature. It is no uncommon thing to see the surface of an asphalt path raised crosswise in an irregular line, as though a small tree root was under it. In every case where the asphalt has been uncovered at these points by the writer, he has found the concrete crushed and the concrete on the falling level thrusting itself under the concrete on the rising level. This effect is most marked on hot days. In January last the writer laid some thousands of feet of asphalt path in St. Luke's Gardens, Chelsea. The sun is on it all day, and during the hot weather at the beginning of June, the number and size of these raised lines was astonishing. Shortly after midday they were most pronounced, and towards night they were less prominent. As a further evidence of the expansion of concrete under the sun's rays the streets in the city can be named. The footway and carriageway are in asphalt on concrete. The expansion of the concrete in the carriageway presses the kerb at the bottom; the expansion of the concrete in the footway presses the kerb at the top on the opposite side, and the two have tilted up the kerb in a marked manner. The writer has on a hot day taken up asphalt on a footway and has found the heat much greater under the asphalt than on the surface. In order to avoid the expansion showing itself in footways the concrete should be laid in sections, and the joints between them filled with some compressible substance.

Compressed asphalt has about one-third longer life than mastic asphalt under the same conditions. The cost is the same, but the use of compressed asphalt for this purpose has not been universally followed by reason of the cracks that appear on its surface. The cracks do not tend to spread under traffic, nor does the asphalt wear more at these parts than at others. They are unsightly, however. It is found that these cracks are exactly of the shape and in the position of the cracks in the concrete foundation. Compressed asphalt has no elasticity in itself, and when subjected to the contracting force of the concrete it is torn through. It is an admirable tell-tale of the movements of the concrete. Much ingenuity has been displayed in endeavors to avoid the cracks. The first step was to localize them. This was done by laying the concrete in 12-foot bays and in alternate bays, and filling up the screed space with fine concrete. The contraction then showed its effects at these places, with a result that a series of regular straight cracks appeared instead of the irregular tree-like cracks when the concrete was laid in one piece. These effects can be seen at many places in London without specifying any particular place. Having localized the cracks, an experiment was made at Hornsey to avoid them. A strip of bituminous felt six inches in width and $\frac{3}{4}$ -inch thick was placed on the concrete over the whole length of the screed mark. This felt has much elasticity, and the object of the experiment was to ascertain whether it would take up the contracting movement of the concrete and absorb it. The length is laid at Crouch Hall Road, between Coolhurst Road and Clifton Road. The result has been that instead of one crack at each screed mark there are two, one on each side of the narrow strip of felt. It is evident that the concrete in contracting compresses the asphalt longitudinally, and that the cracks appear at the points where the opposing motions meet; and as the strip of felt represented a narrow area which was free from these forces, a crack appeared on each side where the forces took effect.

(TO BE CONTINUED.)

STATE BOARD OF HEALTH OF MASSACHUSETTS.

INSTRUCTIONS FOR COLLECTING SAMPLES OF WATER FOR ANALYSIS.

1st.—*From a Water-Tap.* The water should run freely from the tap for a few minutes before it is collected. The bottle is then to be placed directly under the tap, and rinsed out with water three times, pouring out the water completely each time. It is then again to be placed under the tap and filled to overflowing, and then a small quantity poured out so that there shall be left an air-space under the stopper of about half an inch. The stopper must be rinsed off with the flowing water, and inserted into the bottle while still wet, and secured by tying over it a clean piece of cotton cloth. The ends of string must be sealed on the top of the stopper. Under no circumstances must the inside of the neck of the bottle or the stem of the stopper be touched by the hand or wiped with a cloth.

2d.—*From a Stream, Pond, or Reservoir.* The bottle and stopper should be rinsed with the water, if this can be done without stirring up the sediment on the bottom. The bottle, with the stopper in place, should then be entirely submerged in the water, and the stopper taken out at a distance of six to twelve inches below the surface. When the bottle is full, the stopper is replaced below the surface, and finally secured as above. It will be found convenient in taking samples in this way to have the bottle weighted, so that it will sink below the surface. It is important that the sample should be obtained free from the sediment on the bottom of a stream, and from the scum on the surface. If a stream should not be deep enough to admit of this method of taking a sample, the water must be dipped up with an absolutely clean vessel and poured into the bottle after it has been rinsed.

The sample of water should be collected immediately before shipping by express, so that as little time as possible shall intervene between the collecting the sample and its analysis in Boston.

The accompanying "certificate" must be filled out carefully and enclosed in the envelope shipping tag. By the order of the

STATE BOARD OF HEALTH OF MASSACHUSETTS,
S. W. ABBOTT, Secretary.

CERTIFICATE

Accompanying a Sample of Water to be enclosed in the envelope tag addressed to the State Board of Health, Boston.

SAMPLE OF WATER.

From.....(Name of city or town.) Collected and sealed by.....(Name and address of collector.) Collected from.....(State whether the water is from a tap, or from stream, pond, reservoir or other sources.) Collected on.....(Give day, date, and hour of day.) Shipped by..... Express.....(Give date and hour of day.)

REMARKS.—In case there are any abnormal or unusual conditions existing in the source of the water mention the facts. As for instance, if the streams or ponds are swollen by recent heavy rains; or are unusually low in consequence of prolonged drought; or if there is a great deal of vegetable growth in or on the surface of the water. Write on the other side of this Certificate.

COMMONWEALTH OF MASSACHUSETTS.
OFFICE OF STATE BOARD OF HEALTH,
13 BEACON STREET, BOSTON, May 23, 1887.

To.....

The State Board of Health intend to make monthly analyses for the ensuing year of waters used for domestic supplies within the State, and in connection therewith desire to obtain general information respecting the several water-supplies. They therefore request that you will send such printed information as you can; particularly reports describing the construction of your works, the occurrence of any unusual tastes, or growths of vegetation in or upon the water, or any general disease affecting the fish in the streams, ponds, and reservoirs.

An answer is requested to such of the questions in the accompanying blank as are applicable to your works.

The library of the board now contains the reports mentioned below.

Respectfully yours,
F. P. STEARNS,
Engineer State Board of Health.

COMMONWEALTH OF MASSACHUSETTS.

STATE BOARD OF HEALTH.

Please fill out such portions of this blank as are applicable to your works, and forward to F. P. Stearns, Engineer, State Board of Health, 13 Beacon Street, Boston.

Some of the blanks have been filled from information now in the possession of the Board: Please correct if wrong.

- DATE..... 188..
1. Name of city or town.....
 2. Population, 1885.....
 3. Date when works were built. (If not all built at one time, state what additions were made, and when.).....
 4. By whom are works owned?.....
 5. Source or sources of water-supply.....
 6. Area of water-shed supplying such source or sources.....
 7. General geological and topographical character of the water-shed.....
 8. Mode of supply, whether by gravity or pumping, and whether distributing reservoir or tank is used.....
 9. General description of storage and distributing reservoirs,—natural or artificial, how constructed, area of water surface, capacity, character of bottom, amount of shallow flowage, etc.....
 10. Does all water pumped go through the distributing reservoir or tank?.....
 11. What portion of the water pumped goes into the distributing reservoir?.....
 12. Whether or not the water is delivered into the distributing reservoir at one side and drawn out at the other.....
 13. Number, kind, size, and depth of wells used as sources of water-supply.....
 14. Describe filter-galleries or basins, and connections, if any, with stream, pond, or reservoir.....
 15. Daily average capacity of works in dry year.....
 16. Daily average consumption.....
 17. Number of persons using the water.....
 18. Is water supplied to any one outside of your town or city?.....
 19. Material of distributing mains.....
 20. Material of service pipes.....
 21. Does the water-supply receive sewage, drainage from factories (ment oning kind), or other pollutions?.....
 22. If there have been any bad tastes in the water, or excess of vegetable growth, or if the fish have been generally affected, and such occurrences are not fully described in printed reports, please describe the same and the remedy adopted, if any.....
 23. Have analyses of water from the present source been made?..... By whom?..... When?..... If not given in printed reports, please furnish copy of same.....
 24. Have records of the temperature of the water been taken in the past?..... If not printed, will you furnish copies if blanks are sent?.....
 25. Will you keep records of the temperature of water in the future, if a thermometer and blanks are furnished?.....
 26. Will you furnish samples of water for analysis each month, and forward at stated times by express, if bottles are supplied?.....
 27. To whom shall future correspondence be addressed?.....
 28. Name and address of collector of samples.....
 29. Name of Express Co.....
 30. Name of person furnishing this information.....

IMPORTANCE OF APPLIED ARTS AND THEIR RELATION TO COMMON LIFE.

We abstract the following from a paper on this subject, read by Mr. Walter Crane, before the Society of Arts, London, and printed in the *Journal*.

Under a commercial system of production and exchange, all art has been rigidly divided into classes, like the society it reflects. Since we have to sell it across the counter, as it were, we must take the weights and scales to it; we must apply to an article of commerce the tests and standards of commerce. Thus, we have divided beauty and use, and made them up in separate parcels; or, perhaps, having reduced both to powder, we try a conscious blend of the two to suit average tastes. We have the arts all ticketed and pigeon-holed on the shelves behind us. We have "industrial," "decorative," or "applied" art, as we now call it, and "fine" art. Fine art and "the arts not fine," as my friend Mr. Lewis Day has it. Thus, by degrees, the vast general public, who must get their ideas of art, like other things, ready made, have been taught to understand by the word "art" chiefly that form of portable, and often speculative, property—cabinet pictures in oil. Nor is this altogether wonderful, considering how, under our system of wholesale machine production, the appliances of common life have lost their individuality, interest, and meaning, together with their beauty. We are not sensible of any particular individual effort of thought or invention in an object which is only one of thousands turned out exactly like it. Plates, cups, and bowls, chairs, and tables; the molding and paneling of our wood-work, and the metal-work of our sacred hearth itself, are taken as matters of course, like other productions of commerce. They were not specially made for you and me; they must be made to suit Smith and Jones equally well, or equally ill; and we shall probably be charmed to see them in each other's houses. We know the furniture and fittings are only made to sell at a profit while the fashion lasts. Trade demands its "novelties" every season, and it would never pay to let a man sit contentedly in the chair that was solidly built for his grandfather. Much better let him fall between two stools in his uncertainty as to in which of the confidently named upholsterers' styles to seat himself.

Then, as to the application of art to the walls of his dwelling itself, is the average man in a much better case? You cannot expect him to put up costly and permanent decorations for the benefit of his landlord, either outside or inside. He is a wandering hermit-crab, only too glad to find an empty shell that will reasonably fit him, at a not too exorbitant rent—and as for decoration—well, at least there are paint and paper-hangings.

Economic conditions prevent our artisans from being artists. They have become practically, and speaking generally, slaves of machines. The designer is another being from the craftsman. It is only by a study of the conditions of the material in which the design is to be carried out, that we can get even workable designs; and even at the best, the designer who has no practical acquaintance with any of the handicrafts, necessarily loses that stimulus to invention, that suggestive adaptability which the actual manipulation of the material, and first-hand acquaintance with its own peculiar limitations and advantages, always gives.

One who develops a faculty for design has rarely a chance of being other than a designer. He has no time to make experiments—to strike out new paths; he must stick to the line by which he has become known, in order to get a living. Nothing narrows a man so much as working continually in the same groove. The utmost that can be said for specializing a single capacity is that you get an extraordinary mechanical or technical facility at the cost of all other qualities. It may not be possible to be supreme in more than one art, but the arts illustrate each other, and a knowledge of other arts, and their capacities and limitations, is sure to react upon an artist's practice in the one which most absorbs him. It is true we hear of artists here and there, who, though in the eye of the world inseparably associated with some particular form of, say, pictorial ability, nevertheless cultivate some secret amour in the form of a handicraft.

Among the secondary reasons for the decay of inventive and spontaneous design in the applied arts, I believe the hard and fast line which has been drawn between the artist and the craftsman is answerable, and the separation of the designer and the workman. The designer is, perhaps, kept chained to some enterprising firm. Novelties are demanded of him—something entirely new and original—every season, but not too much so. It is not surprising that the best talents should get jaded under such influences; that fancy should become forced or fantastic, and motive weak and tame, or perhaps lost altogether in a search after superficial naturalism, in defiance of fitness to material or use. Such a Nemesis is too apt to overtake the specialized designer, who designs on paper only, without the stimulus of close acquaintance with, and practice in, some handicraft. The mere change of occupation is refreshing and invigorating, and stimulate the inventions.

In so far as I have been successful as a designer, it has been, I believe, largely owing to my making myself acquainted with the conditions of the material in which a design was to be carried out; by striving to realize, in thought at least, the particular limitations and conditions under which it was intended to be worked; and I have always found that those very limitations, those very conditions, are sources of strength and suggestion to the invention. For I am old-fashioned enough to believe that every material has its own proper language—regarded as a medium for expression in design—and it is the business of the designer to find this out.

THE VALUE OF THE WORKS OF THE MONONGAHELA NAVIGATION COMPANY.

As COMPETITION becomes closer in the transportation interests every item of cost is closely examined to see if a saving cannot be effected. An examination of this kind has shown that the tax in the way of tolls on every bushel of coal moved through the locks of the Monongahela Navigation Company is about seven cents. The United States have made improvements both above and below, but this anomaly remains of an enforced payment on all commerce passing this intermediate section of the river.

The subject was reported upon in December last by a board consisting of Majors W. K. King, Amos Stickney, and A. Mackenzie, of the U. S. Engineers. They state that originally the river was not navigable except at certain stages. The improvements have been mostly by private parties, and have opened up an immense commerce. But the tax resulting has become a serious discrimination against the commerce as compared with other sections. The Navigation Company was incorporated in 1836 by the Pennsylvania Legislature, and there have been passed in all thirty-three acts affecting it. These provide, among other things, that the State may at the end of twenty-five years after the completion of the works purchase them at a sum equal to cost and improvements and keeping the same in repairs, with eight per cent. interest per annum thereon.

The works of the dam consist in all of seven locks with lifts of 8 feet to 14 feet. All were at first constructed 190 feet long and 50 feet wide; but additional locks have been placed at four dams which are 56 feet wide and 250 feet to 312 feet long.

The average shipment of coal for the past ten years has been 85,000,000 bushels per year, and the tolls collected for those years averaged \$225,000 per year. There are now 71 coal mines on the river, employing 15,000 men, and the money value of the commerce "far exceeds that of a majority of the streams upon which the United States Government has expended millions of dollars in improvements."

The stock of the company is stated to have sold before the agitation for the purchase of the works at a premium of 80 per cent., making, on a basis of 4½ per cent. interest, a total present worth of \$4,000,000. On the basis of sales of stock at various dates at \$100, \$89, \$82, the total share value would be about \$2,000,000 to \$2,200,000. The share capital between times had been increased to cover improvements made. The treasurer estimates that the works as they stand could not be duplicated for less than \$2,250,000 to \$2,500,000. But the board estimates that to make the works equal to new would cost \$300,000, and that the present intrinsic value cannot be more than \$1,950,000.

The only methods apparent to the board by which the general Government can obtain control are:

1st. By condemnation, with assessment of damages by a competent tribunal.

2d. By acceptance or purchase of the works from the State of Pennsylvania, after the State shall have extinguished the rights of the company.

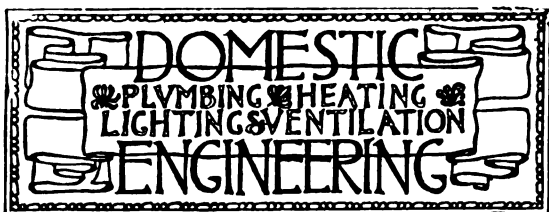
Extensive appendices give the full information upon which the report is based.

We have received a circular letter, addressed to "The Water-Gas Fraternity," calling for the formation of a National Association of Water-Gas Engineers and Superintendents.

The call is signed by fourteen gentlemen connected with the water-gas industry in Chicago, South Boston, Binghamton, Lynn, and other places. It states that there are two hundred and fifty water-gas works now in successful operation in different sections of the country.

While we think that the formation of an association, as proposed, may result in much benefit to its members, we consider it a matter for regret that the water-gas and coal-gas engineers could not be united in one association, representing the gas industry of the country, rather than have several associations who, it will be inferred, are intended to promote the interests of a special system of manufacture rather than the interests of an industry.

INTENSE feeling is being aroused over the dumping of night-soil on the flats below the city of St. Paul, Minn. It is proposed now to move the dumping-place 10 miles from the city or burn all the refuse.



IS A TRAP ON THE MAIN DRAIN OF A BUILDING A NECESSITY?—FRESH-AIR INLETS, THEIR LOCATION AND TERMINATION.*

AN UNSAFE SUGGESTION.

WORKMEN of whatever craft have their particular method of executing any part of the work pertaining to their trade, and every competent workman has, or ought to have, some argument to offer in support of the plan of work followed by him; also, every such workman, eager to do the best work possible, and to have the best plans for doing it, invites discussion upon his system of plans, listens with interest to the argument for or against, and is ever ready to hear statements of new plans and willing to adopt them for his own, if convinced of their superiority over those formerly used. It is with a firm belief in the truthfulness of these opening statements that we attempt a brief discussion of the double subject selected by us, and submit another plan for accomplishing the same work, together with some arguments in support of the same.

To begin a discussion of the subject selected, we assert that for the welfare of the parties interested, a trap on the main drain of a building is necessary, and since the necessity of a trap argues the necessity of inlets, we will consider in this connection fresh-air inlets, their location and termination. That the trap and inlets must be used together needs no discussion, for to have a trap without a fresh-air inlet would be a greater blunder than to leave off the trap entirely, and if no trap is put on the main drain there can be no use for the fresh-air inlet.

In arguing for a trap on the main-drain we would state, first, that such a trap guards against any evils that may arise through mistake or oversight in the drainage or ventilation of plumbing-work, and we contend that no workman, be he journeyman or master plumber, can avoid making some mistakes during his experience that will serve as invitations to sewer-gas to enter houses. We do not believe in inviting sewer-gas into houses under any circumstances whatever, and advocate every means for keeping it out, or at least for limiting the amount; this the trap aids in doing.

Again, the variation in the heights of buildings makes the trap necessary. A party building or owning a house of two or three stories does not stop to consider his neighbor's interests, but discharges the ends of his soil-pipes in the most convenient place. In fact, it would be a difficult matter to support them in position at a height that would be necessary in some cases.

Another argument is, that with a trap the danger of contagious diseases, caused or aggravated by sewer-gas, is lessened. For, in a case where a trap is used, there is nothing to contend against except the foul air contained in the house-drain, which can be well controlled by the occupant of the building by the thorough flushing of the pipes. If, however, there is no trap, the occupant cannot, with all his precautions, have the same control over the sewer-gas.

While we argue for the trap and fresh-air inlets, we believe the present system of ventilation and the location of the inlets is not correct. This is only our judgment and may not be endorsed by others of our craft. We are pleased to state, however, that our judgment in this matter is not the result of fancy theories, but of actual experiments and practiced experience with what we believe to be a better system which we will now attempt to explain. In our locality the plumbing is, as a rule, so arranged that the laundry is placed either in the upper story, above the kitchen, or in the basement directly beneath it; consequently the same chimney is used for both kitchen and laundry flues, the flues being separated. Our plan is to have an extra or additional flue built in the chimney, between the kitchen and laundry flues, this to be constructed of cast-iron pipe and carried above the top of the chimney and capped with globe, Moore, or other good ventilator, also made of cast iron. We then carry what is now known as the fresh-air inlet, full size of house-drain, to this flue and connect it with the same; this done, we proceed with the plumbing as in the present style of ventilation. From our plan given here [referring to diagram accompanying the essay] it will be seen that this reverses the current; instead of having a tendency to flow out at any defect, or up through a fixture the trap of which has been syphoned, the tendency would be downward through the syphoned trap, and inward through any defects. There would be no change in the manner of back-airing or venting fixtures, but in extreme cold climates the upper ends of soil and waste pipes, in our judgment, should terminate in the space between the ceiling of the top story and the roof of the building, and constitute the fresh-air inlets. We expect opposition on this particular point, but, having had this system in use in dwelling-houses for nearly six years, we have practically demonstrated, to our own satisfaction that it is perfectly safe and a great success. The area of fresh-air inlets in no case to exceed the area of the vent-pipe in chimney.

* A paper prepared by Messrs. Richard Murphy and James A. Gibson and read before the National Association of Master Plumbers at the recent Annual Convention.

In presenting some of the advantages derived from this system of ventilation, we would state first, that the frequent unpleasant puffs of foul air through the fresh-air inlets at any discharge of fixtures, and unavoidable under the present system on account of the impossibility of locating these inlets at all times far enough away from the windows, are by the new system entirely avoided. In store-buildings it is very often necessary to locate the inlets in the sidewalk, or extend them through the curb, thus making it very unpleasant for the public; also, while thus exposed, they are apt to become clogged if any elbows or gratings are used. The system we advocate obviates these difficulties. Again, under the present system, there is a possibility of the trap on main drain being frozen, caused by the rush of cold air through the inlet; while by our plan this difficulty is obviated. This system also prevents vent-pipes, at their termination, from becoming useless in very cold weather by being filled with hoar frost, for at that particular time the pipe between the kitchen and laundry flues is hot, and there is not sufficient dampness in the atmosphere to create hoar-frost at inlets, which are the upper end of lines. In store or factory buildings a flue may be built in the stack from the boiler or heating apparatus. Another important feature is that water and air are always traveling in the same direction; at the discharge of fixtures the velocity of air-current is greatly increased, and the air following the water has a tendency to dry out the pipe very rapidly, thereby causing a better draught than in the present system. For, in the present

come filled with hoar-frost and thereby rendered useless, as there would not be sufficient dampness in the atmosphere. If from any cause the seal of the traps is broken, the danger from sewer-gas is greatly lessened, as the draught is downward at all times. The proper place for fresh-air inlets (which in this system should be the upper ends of soil and waste pipes) to terminate, especially in extreme cold climates, is, as previously stated, in the space between the top ceiling and the roof of building, and in this way prevent the traps from freezing, caused by cold air rushing down the different lines of pipe. If it is found that the air in the space between ceiling and roof is cold enough to cause the water in traps to freeze, there may be some arrangement made to heat this space.

Objections may be raised to the end of soil-pipe not being carried through the roof instead of terminating in the attic of building; but with the proper construction and placing of pipes as we have suggested in connection with the heated flues, we have fully demonstrated to our own satisfaction that the evil of pipes terminating above the roof by being filled with hoar-frost in extreme cold weather is entirely obviated. The foul puffs of air, so objectionable in the present system of placing them under windows, or upon sidewalks, are entirely removed. Objections may also be raised to the use of vent-caps, but as the kitchen flue is not always used, for ranges being substituted during the summer months, the majority of people would not go to the expense of heating the flues by other means. We think the use of vent-cap the next best method of creating a

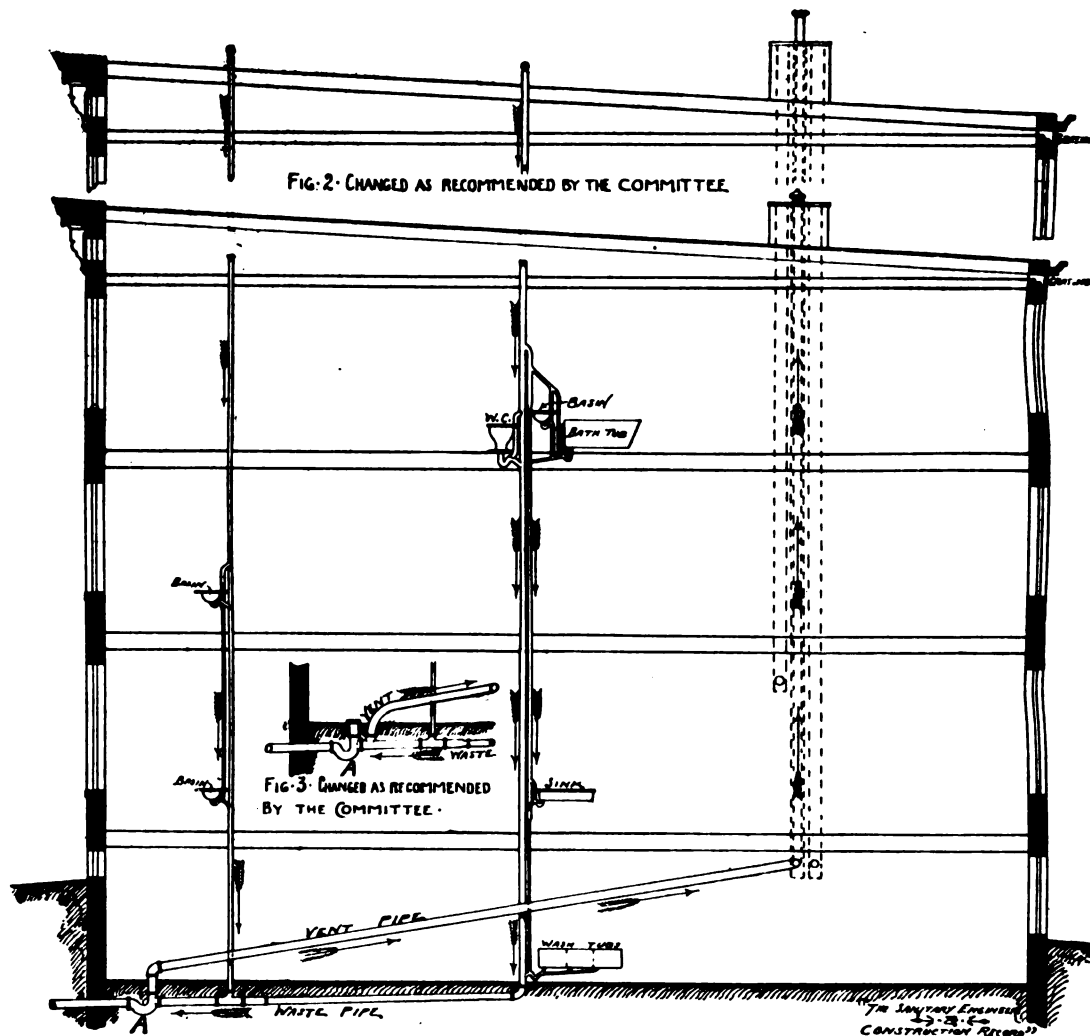


FIGURE 1, AS PROPOSED BY AUTHORS OF THE PAPER.

system, the water and air are traveling in opposite directions, and after the main discharge of water has passed off, the air-current reverses and the water clinging to sides of the pipe is in a measure held in suspense, taking a greater length of time to dry out the pipe.

To show why this system of ventilation is better than others, we will illustrate by giving our opinion of how the different systems would work under the following conditions: Take a large building, say from seven to ten stories high, divided into flats; one or more of these flats are vacated, and the time of year winter and very cold. First, take the house-drain without the trap. The end of the soil and waste pipes above the roof would become filled with hoar-frost, and the house would be practically without ventilation or back-airing. The traps of the fixtures of the unoccupied flats would be syphoned, leaving a direct outlet for sewer-gas into the building. This might occur at any time, however, by evaporation or syphonage. Second, take the present system of ventilation with a trap on the main drain. The end of the soil and waste pipes would become filled with hoar-frost as in the preceding case, and the same action take place. The difference would be the direct opening would be there the same, but in one case the opening would be to the main sewer, and in the other to the foul air contained in the house-drain alone. Thirdly, take the system we advocate. The end of the soil and waste pipes would not be

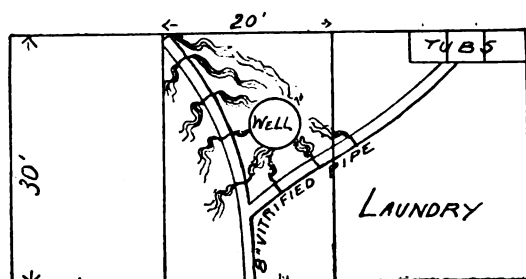
draught, and also of preventing a downward draught, thus keeping the current constantly in one direction.

A word about the main sewers: We do not wish to be understood as opposed to their ventilation, but we think there ought to be other means provided to vent them properly. If necessary, build towers provided with furnaces, and air-inlets left at different points along the line of sewer to give a copious supply of fresh air; the expense to be met by the public, where it properly belongs. Under no consideration are we in favor of ventilating the main sewers through dwellings.

In conclusion, we leave with you a summary of our position on these questions. We believe that for the best interests of those concerned, a trap on the main drain of a building is an absolute necessity. The trap being useless without the fresh-air inlets, we also believe fresh-air inlets a necessity. We oppose the present system of ventilation and the location of the fresh-air inlets as necessitated by that system. We believe that we have, in this paper, advocated a better system, one by the use of which many of the difficulties of the present are overcome; one that is safer, and more conducive to health, and in the long run more economical than the other. And now, fellow-members of this association, we invite your earnest consideration of the points we have tried to make in presenting this paper, and hope that from it you may be able to select some hints, or gain practical help that may lead to

something better, that will serve to advance the interest of every member of the National Association of Master Plumbers of the United States of America.

[It is unfortunate that the gentlemen selected by the Cincinnati Association of Plumbers to consider the question of "Fresh-Air Inlets" on a house-drainage system should have built up a theory on an old notion which has often been shown in these columns to be untrustworthy—viz., that it would be safe to depend on an upward draft being constant in a kitchen chimney-stack, where the fire may often be suffered to go out or become too feeble to insure the desired object. Moreover, the author of the paper adds an extremely unsafe and dangerous item in terminating his soil-pipe below the roof in an attic space. Like other inventors of things more curious than useful, he sets up straw men to knock down, and suggests various bugbears as necessary consequences of the present accepted system. The intelligence of his audience in these matters and the publication of the fact that these experiments have been tried on one or two householders will doubtless prevent any extended adoption of them, and we are glad to notice that a committee at the convention realized the danger of the authors' suggestion.—ED.]



DRAINAGE-SYSTEM, CONANICUT PARK, HOTEL, R. I.,
JULY, 1887.
(See page 261.)

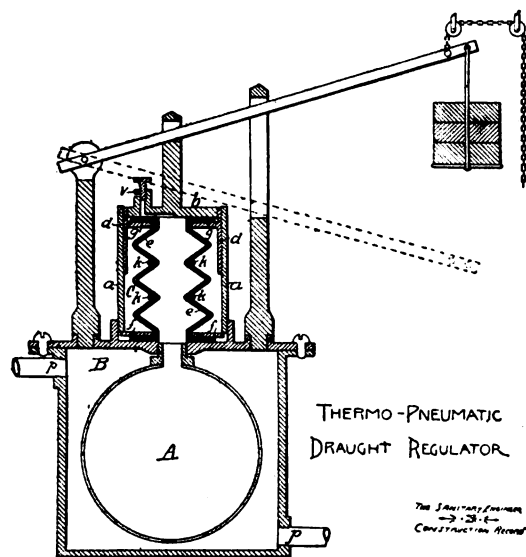
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

AUTOMATIC REGULATOR FOR STEAM OR HOT WATER.

THE accompanying illustration shows a novel steam or hot-water regulator for use either for dampers, draught-door, or air-inlets, lately invented by George E. Dixon, M. E., of Chicago, Ill., and called the Thermo-Pneumatic Regulator.

It consists of three principal parts—viz., the expansion-chamber A, the circulating chamber B, and the dia-



phragm cylinder C, with the lever F and other attachments as shown in the drawing.

The damper or draught-door to be automatically operated is attached to the lever F by the chain or cord in the usual manner.

In the diaphragm cylinder (C) *a a* represents the cylinder; *b* the piston, and *d d* the piston-guide. *e e* is a corrugated or bellows-shaped elastic tube, with flanged ends, made of rubber or other suitable materials so as to form a "bellows diaphragm."

The lower flange of this diaphragm is secured by the annular plate or gland *f f*, which in turn is held in position by the cylinder *a a*, forming a screwed joint at the base. The upper flange of the diaphragm is secured between the piston *b* and the piston flange *e*, forming a tight joint at the top of the cylinder. The diaphragm expands and contracts in accordance with the travel of the piston and allows of the piston being an easy fit in the cylinder so that it may travel without appreciable friction.

The metal rings *k k* are placed around the narrow portions of the corrugations to strengthen the diaphragm against excessive internal pressure. The valve *V* is a vent and regulating-valve, communicating with the expansion-chamber A through the bellows diaphragm. The expansion-chamber is enclosed in the circulating water chamber B, and it is attached to the base of the cylinder C by a screwed nipple as shown. The steam or hot water passes through the circulating chamber by the pipes *p p*, and are connected with the boiler or heater by pipes and stop-valves by which the circulation can be regulated or entirely shut off. The operation of the regulator is as follows:

The expansion-chamber A is allowed to fill with air through the regulating valve *V* which is then tightly closed and counter-balance weights put on, sufficient to bring the lever *F* down to the position shown by the dotted lines, thus throwing the dampers or door attached to the chain *n* wide open. The steam or hot water is then admitted to the circulating chamber B, and as this heating medium increases in temperature, the temperature of the air confined in the expansion-chamber A increases, producing a proportionate increase in volume, thus raising the piston *b* and the lever *F* and closing the damper or other device attached to the chain *n*.

The necessary increase in volume and consequent pressure required to raise the piston *b* is regulated by the addition or removal of counter-balance weights.

If too much pressure is produced in the expansion-chamber A it may be reduced by withdrawing a portion of the expansive medium by the regulating-valve *V*.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
July 30.....	25.90	21.31	21.02	29.13	25.72	21.78	31.06

E. G. LOVE, Ph.D., Gas Examiner.

ACCORDING to the report of the Chief Gas Examiner of London for the quarter ending June 30, the average illuminating power of the gas supplied by the Gas-Light and Coke Company was 16.59 candles; that of the Commercial Company, 16.75 candles, and that of the South Metropolitan Company, 16.43 candles. In no instance did the sulphur or ammonia exceed the limit.

THE *Gas and Water Review* expresses the opinion that the Clamond incandescent gas-burner, which is soon to be put upon the market, "will mark a distinct departure in gas-lighting." It refers to certain tests in which the yield was about 5.5 candles per foot of gas. Regarding the construction of the burner, it says: "The burner gives a very pure, white light; the 'cone' or envelope is made of magnesium, and covers the gas passage; when the gas is lighted the cone in a few seconds becomes perfectly incandescent. It can with ease be applied to the ordinary fittings. We have been given to understand that the cones will stand a considerable amount of usage. The Clamond lamp is also made in an inverted form, after the manner of the more generally known regenerative burners, and in this form it is admirably adapted for large buildings. The combustion is extremely perfect."

THE effect of the Electric-Lighting Act, which was passed by Parliament in 1882, is clearly shown in the following resolution, which, according to the *Electrician*, Mr. Hugh Watt intends to present in the House of Commons: "That the Electric-Lighting Amendment Bill in-

roduced by Lord Thurlow in the House of Lords having been deprived of its most important provision by the decision of the Committee of that House, and thus rendered useless for the purpose for which it was intended, no measure short of a repeal of the Electric-Lighting Act (1882), and the substitution thereof of legislation rendering it possible to supply electric-light to the public with a fair prospect of remunerative returns, will be of any benefit to the electric-lighting industry, and as that bill has to a very large extent destroyed the growth of the industry in this country and driven the export trade into American hands, it is desirable that the aforesaid act be forthwith repealed, and those engaged in this new industry (which now employs nearly £50,000,000 of capital, and over 50,000 workmen in America) be freed from the fetters of legislation, which have proved of so disastrous a character."

THE *Lancet* remarks that the observation of M. D'Arsonval that dynamic discharges and alternating currents do not (like static discharges) produce serious organic disruption of the lining tissues is not a new discovery. The special disruptive and fatal effect of the static discharge has long been known in this country, and was most fully brought out in Dr. Richardson's experiments on death by electric shock, conducted in the Royal Polytechnic Institution in 1869. In those researches sheep and other animals were killed by the static discharge, and the cause of death was shown to be due to the sudden expansion of gaseous parts of the blood and tissues, by which organic lesions of the most extensive kind were induced. In one of this series of experiments the skull of a dead animal was fractured by the static discharge, and arborescent markings of external veins, distortion of large veins, rupture of the heart, ecchymosis, rupture of the stomach, and decomposition of the blood itself, from the same kind of discharge, were phenomena traced to disruption from gaseous expansion. At the same time the static discharge does not always kill. It may simply stun, or cause a temporary anæsthesia, or produce a state resembling catalepsy, followed by recovery.—*Electrician*.

THE *Gas Engineer*, speaking of the recent improvements in Harcourt's pentane lamp, and the use of the "cut-off" for the flame, says: "Careful experiments show that no perceptible difference can be detected in the value of the light below the cut-off, although the difference in the total height of the flame would produce 12 per cent. difference in its value."

THE Board of Health of the city of Keokuk, Iowa, published its first report in March of this year, and we are glad to see that it begins by an attempt to take an account of stock, as it were—that is, to describe the actual situation of the city from a sanitary point of view. To begin with, there were 197 deaths. Dr. Shaffer says: "Place the population at 16,000, which many claim, and the death-rate is 12.31." Therefore, the population is probably not 16,000, but nearer 13,000.

Dr. Shaffer begins by commenting on certain points, which he declares to be a nuisance; and on the alleys, which he says "are the receptacle of all manner of filth and nastiness," which is in part accounted for by the fact that the manure from horse and cow stables is piled in them. He says: "The privies of this city are a counterpart of those found in the most obscure hamlets of the land. They, externally, are of nearly uniform architectural design, 4x4 feet at base and 5 to 6 feet high. They are located at the rear end of the lot and stand out prominently in the landscape. Internally they stink at all seasons. The vault, or hole in the ground, is a 'dug out,' not cemented; perchance a cask is fitted in the excavation. Very many are on the surface, and friendly rains are the means of washing away excrements into a no less friendly alley. In hundreds of cases the privy thus constructed is several feet higher than the house or the cistern. The cistern is not cemented."

After stating that the cost of the Board of Health for the year was \$158, he dryly closes his report with the remark that the Board of Health is not getting especially rich from the labor it is performing.

Keokuk is probably neither better nor worse than many comparatively new Western towns which have not yet got beyond the primitive village methods of disposing of refuse and excreta. There is a vast amount of cleaning up and sanitary work to be done in such places to make them fit for permanent habitation, and those which defer this work too long will receive a permanent check to their prosperity. Meantime we hope that the Board of Health of Keokuk will continue to hammer away at nuisances, and will soon be better paid.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A SEWERAGE SYSTEM WANTED.

CLINTON, Mo., July 26, 1887.

SIR: I am induced to ask you the following questions: Is there any work extant on sewerage? Who has handled sewerage in a level country? We shall build sewers soon. We have water-works, gas-light, electric-lights, an artesian well 800 feet deep now flowing 260 gallons per minute, and street-cars in the near future. The city has a population between five and six thousand, is out of debt, but must have sewers now.

Your answer will greatly oblige your humble servant,
M. A. KITCHEN, Mayor.

[Vol. 7 of THE SANITARY ENGINEER AND CONSTRUCTION RECORD contains a large amount of matter relating to this subject; the price is \$3. Philbrick's "American Sanitary Engineering," price \$2, obtainable of the Book Department of THE SANITARY ENGINEER AND CONSTRUCTION RECORD, would be a useful book for the mayor or public officials of any town contemplating the introduction of a system of sewers, as it gives a general idea of the character of the problems involved. It will indicate the importance of employing an engineer of experience in this special department of engineering by any city contemplating the introduction of sewers, the names of a number of whom will be found in the professional column of the advertising pages of this journal.]

It is a great mistake to suppose, however, that the reading of any book or books will enable one not possessing special training and experience in these matters to economically and efficiently sewer a town. Your city can well afford, and will find it cheapest in the end, to pay a competent man to advise you in these matters. "The Separate System of Sewerage, Its Theory and Construction," by Prof. Cady Staley and George S. Pierson, price \$2.50, is also a useful book to those constructing small pipe sewers, though the construction described is mainly that adopted in the city of Schenectady, in New York State.

To dispose of the sewage of a level district is more expensive than where topographical conditions are more favorable. An experienced engineer, however, will be able to select the method most economical, with due regard to efficiency under the circumstances.]

RULES FOR FIGURING STEAM-HEATING SURFACE.

HONESDALE, PA., July 18, 1887.

SIR: Since using Baldwin's "Steam-Heating for Buildings" for computing heating surfaces, I have had several encounters with steam-heating men, and in every case I have found by his rules less steam-heating surfaces than they claim to use. Will you kindly figure the following for me by his rules and see if I am correct?

I want to warm a well-built brick house situated on the north-east corner of — street. It has hard-finished walls, papered. The sitting-room is 16x20x10 feet, has 160 square feet of wall exposed to west wind, 200 square feet of wall exposed to north wind, 63 square feet of glass surface; desired temperature 70°, 10° below being about our lowest outside.

I figured that 57 square feet of direct heating-surface was necessary and would answer. Am I right? This is taking it for granted that the house is properly warmed in other rooms and hall. The room mentioned is on the first floor, two feet above the level of the sidewalk, and is unusually tight, so far as joiner-work is concerned.

Yours truly,

W.

[To figure for a room 16x20x10 feet high—hard-finished walls—Baldwin's rules (pages 26 and 27, eighth edition), we have 16' x 10' = 160 □ west wall,
20' x 10' = 200 □ north wall,

360 □ total for both outside walls, less the window area—which you give at 63 square feet = 297 square feet of cold walls.

He considers the cooling value of a square foot of a hard-plastered wall (one without furring and lathing) to be one-fifth the value of a square foot of glass, which places the total value of the wall in cooling powers as equal to 59½ square feet of glass. To this, according to his rule, we must add the glass and treat all as glass. Thus we have 59½ + 63 square feet of glass = 122½ square feet of glass, or the equivalent thereof if it were all glass.

Then, to find the amount of average pipe surface that will warm as much air as a square foot of glass will cool, he says: "Divide the difference in temperature between

that at which the room is to be kept and the coldest outside atmosphere by the difference between the temperature of the steam-pipes and the air of the room," and the product will be the square foot of pipe surface that will offset the cooling of a square foot of glass.

According to this, then, we have room 70° Fah., outside temperature 10° Fah. (below) = (difference) 80° Fah. Again, temperature of steam-pipe 212° Fah. less temperature of air of room = 142° Fah. Then $\frac{80}{142} = .563$ as the plate or pipe surface, in square feet, that will offset a square foot of glass.

According to this, then, we have $122.4 \times .563 = 68.91$ square feet of pipe or radiator surface to offset the cooling done by the walls and windows. To this must be added the amount of radiator surface necessary to warm the air admitted to the room in an hour. For instance, your room has a cubic contents of 3,200 cubic feet, and say it changes twice in an hour and is warmed from 10° below to 70° above.

Then we have $\frac{3200 \times 2 \times 80}{50} = 10,240$ heat-units; in which the (50) is the approximate number of cubic feet of air that a heat-unit will warm one degree Fah. This, say, is the equivalent of 10 pounds weight of steam and requires about 30 square feet additional of radiator surface to condense it. Thus we have $68.9 + 30 = 98.9$ as the total quantity of pipe in square feet for 10° below zero.

If your room is a tight box, or nearly so, 70 to 75 square feet will do, but should air be admitted accidentally or otherwise it must be provided for on the above basis.

Although the mercury may reach 10° below at an odd time in your neighborhood, we think 10° degrees above as amply low to figure on as a basis of calculation. This will lessen the surface by $\frac{1}{4}$, or to about 75 square feet for your room. With 98.9 square feet of radiator in such a room it is 1 square foot to about 33 cubic, and with a radiator of 75 square feet it is about as 1 to 43, and, as the steam man usually figures it, either of them appears pretty ample.]

DANGER OF FIRE IN SUMMER HOTELS.

NEW YORK, July 21, 1887.

SIR: A great deal has been written about the sanitary condition of our summer resorts, but have you ever thought of chances of fire in such hotels as at Long Branch? It makes me shudder to look at them and think of it. It seems to me that each and all of them should have fire-proof stairs inclosed by brick walls. They might be towers and ornamental features of the buildings. This is something for Dr. Hunt, of New Jersey, to think of.

Respectfully, ARCHITECT.

CERTIFICATES TO PLUMBERS' APPRENTICES.

GERMANTOWN, PA., July 20, 1887.

SIR: Would you let me know how to word an apprentice certificate? I having served four years with a master plumber of Germantown. Having seen in your paper that in other cities plumbers give certificate, my boss is willing to give me one if I would get the wording of them—just the part that is to be printed. If you could send them to me you would oblige,
GERMANTOWN.

[Referred to our readers.]

ERRATUM.

In the "Thermus" article on "Hot-Water Heating and Fitting" in our issue of July 20, page 212, the cuts Figs. 18 and 19 should have been turned so the arrows would appear to move in an upward direction. Through a misunderstanding, also, the numbers were placed at the wrong end of the cuts.—ED.

RECKLESSNESS OF BRIDGE-BUILDERS.

PEOPLE who have been watching the erection of the false-work at the east shore anchorage pier at the bridge and out in the river between piers 2 and 3 have been wonderfully interested in the agility and what seemed to them dare-devil recklessness of the trained men on the job. They have seen them crawling along the girders and braces nearly a hundred feet high, leaping from timber to timber, or running along the narrow planking, now stooping over to aid in the hoisting of timber or iron, now standing on the extreme edge of the river front of work peering down upon the rocks and river below, or going along hand over hand among the braces with apparently as much ease and comfort as though moving along on terra firma.

"They are all used to that kind of work," said General Field, of the Union Bridge Company, "and have no fear whatever. When we were building the cantilever over the whirlpool rapids of Niagara, 240 feet above the rushing waters, they were just as daring as they are here. I remember when we had the job about completed I was up there one day. The cantilever arms were within fifty feet of each other, and it was decided to connect them tempor-

rarily with a plank. This plank was fifty-five feet in length, about two and a half feet of each end resting on the cantilever arms. The foreman had issued a strict order prohibiting any of the men from crossing the plank until it was firmly fastened at each end, the penalty being immediate dismissal. There had been a great deal of talk among the men as to who would be the first one to cross. I was standing on the American side looking at the structure when I saw one of the men walk out on the plank, look at it a minute, then looked down into the whirlpool below. I felt that he was going to cross the plank, but I was too far from him to make him hear. He waited a second or two, and then deliberately walked out on the plank, and when he reached the middle of it he stooped over, seizing the edges of the plank with both hands and, throwing his feet up, he stood on his head and kicked his heels and shouted to the terrified lookers-on. He must have been a minute doing it, but I felt as though it was half an hour. After satisfying himself that he had kicked enough he regained his equilibrium and then trotted along the plank to the opposite side, from where he started, seized hold of one of the iron braces of the cantilever and went down it head first, hand over hand, to the bottom. I never saw anything like it before. Of course the foreman discharged him and he was laid off two or three days, when I sent for him. He was one of the best men on the job, and I talked to him like a Dutch uncle and put him to work again. These men have no fear; they are brought up to the business and feel just as safe 150 feet in the air as they do on the ground. Of course, I can see how the people wonder at such things, but we have got used to it. The best time to see them travel is at the dinner hour, or when the day's work is completed."—Poughkeepsie Eagle.

COMMISSIONER OF PUBLIC WORKS JOHN NEWTON, of New York City, has invited Rudolph Hering, C. E., of Chicago, to make an examination, in conjunction with Colonel Julius W. Adams, of the entire sewerage system of the city with a view to its improvement and enlargement. The preliminary work will be finished in a few days.

ARCH STONES, NEW CROTON AQUEDUCT.

AT shaft 23 the voussoirs, or arch stones connecting brick arches of tunnel with the shaft, were set on Tuesday, August 2; and brick masonry of shaft has been carried up to necessary height for receiving the iron castings, which will have special dimensions, as the tunnel at this point will be under pressure. This is the first work of the kind completed on the aqueduct.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

THE annual meeting of the society, will be held in Philadelphia, Pa., in the latter part of the month of November, 1887. The exact date and details will be the subject of a later announcement. Applications for membership to take effect at this meeting should be in the Secretary's hands by October 1. To admit also of earlier distribution of the printed papers in advance of the meeting, and more time for the preparation of discussions upon them, the manuscripts of papers for this meeting should be forwarded to the Publication Committee before September 24. The Secretary would also like to have authors forward at once to him the titles of papers for the meeting, in advance of the preparation of their text.

WE have received a large, neatly-framed photograph showing the stand-pipe of the Massillon, O., Water-Works, of which S. R. Bullock & Co., of New York, are the owners. The stand-pipe was built by Messrs. Tippet & Wood, of Phillipsburg, N. J., and is 25 feet in diameter and 150 feet high.

PERSONAL.

MERTILLOW R. CLAPP, President of the Clapp & Jones Manufacturing Company of Hudson, N. Y., died July 27 of Bright's disease, aged 60 years. Mr. Clapp was the inventor of the steam fire-engine bearing the name of his company.

ENSIGNS G. W. STREET and J. W. McKay, of the U. S. Navy, have been selected by the Secretary of the Navy to take a course of study in France to fit them to become constructors in the recreation of the navy.

GEORGE L. RIVES has been appointed by Mayor Hewitt a member of the Rapid Transit Commission in place of Peter B. Olney, resigned.

THOMAS T. WIEMAN, Jr., Chief Engineer of the Pennsylvania Canal Company, died at his home in Harrisburg, Pa., August 2, aged 73 years. He had been connected with railroads and canals in Pennsylvania for many years.

L. F. BILLINGER, C. E., has been appointed to a chair of engineering and architecture in Norwich University, Vt.

MR. G. H. RANDALL has been appointed City Engineer of Fond du Lac, Wis., succeeding Mr. N. Boardman, resigned.

MR. JOHN G. LOW, of Chelsea, Mass., has devised a battery and incandescent electric lamps for carriage-lighting.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

Preliminary sketches by W. J. W. Howe, Jr., will be sent to the three architects whose plans for the Birmingham, Ala., Court-House were the best in the previous competition, and they will be asked to submit new plans.

MILWAUKEE, WIS.—H. C. Koch & Co., Ed. V. Koch & Co., George B. Ferry and H. B. Schnetzky, Milwaukee architects, have presented plans for the Ninth Ward school, also for two school-buildings in the Fifteenth ward.

In the competition for designs of the Seventh Ward school-building at Syracuse, N. Y., C. E. Colton's design was selected. The cost will be about \$29,800. The other competitors were Baxter & Hull and A. L. Merrick.

KANSAS CITY CHURCH COMPETITION.—Competition has been instituted somewhat on the lines of the Kansas City Building Exchange Building Competition for plans for the new Grace Episcopal Church. Messrs. C. W. Edlitz and McKim, Mead & White, of New York; Burling & Whitehouse, of Chicago, and Adriance Van Brunt, of Kansas City, have been invited to prepare preliminary designs, for which they are to be paid \$200 each. No professional adviser, however, is provided for as in the case of the recent Kansas City competition. Other architects are invited to compete. Full particulars may be obtained by addressing F. E. Tyler, Secretary, 622 West Seventh Street, Kansas City, Mo.

PROPOSALS.

ELECTRIC ALARMS.—The Common Council of the city of Trenton, N. J., will receive at their meeting, in the City Hall, August 16, proposals for furnishing eighteen new electrical police patrol boxes, and a central office plant for a police patrol system, and for furnishing necessary wires and apparatus therefor, and for putting the same in working order, according to the specifications now on file in the office of the city clerk.

Also, separate proposals for furnishing a one-horse police patrol wagon, with equipments complete. Jno. C. Owens, City Clerk.

IRON WORK for Morse Peake Light Station, Maine. Until August 15. Address, Major W. S. Stanton, U. S. Engineer, Post Office Building, Boston.

STONE RIP-RAP for Back River Light Station, Chesapeake Bay, Virginia. Until August 13. Address, Capt. J. C. Mallory, U. S. Engineer, Light House District, Baltimore, Md.

LEEVE WORK.—Proposals for the construction of 660,000 cubic yards of levee work at Kempe and Deer Park, La., are asked for by Capt. Dan C. Kingman, U. S. A., No. 3 So. Rampart Street, until September 1.

DREDGING.—Major A. N. Damrell, U. S. A., Mobile, Ala., asks proposals for dredging in Biloxi Harbor until August 17.

ARMY buildings, twelve in number, at San Antonio, Tex. Until August 23. Address A. J. McGonigle, Quartermaster, U. S. A., San Antonio, Tex.

STEAM-HEATING AND WATER-SUPPLY.—Proposals will be received at the office of the Board of Trustees in Jamestown, D. T., until August 27, for putting in steam-heating and water-supply for the North Dakota Hospital for the Insane. Drawings and specifications can be seen at the office of the Board of Trustees, Jamestown, D. T., and office of Willett & Pashley, architects, 207 Dearborn Street, Chicago, Ill., on and after July 27. F. E. Jones Secretary.

STREET WORK.—Proposals will be received at the office of the Board of Public Affairs, of Cincinnati, until August 25, for the improvement of Charles Street, from Colerain Avenue to the east line of Fifth Avenue, by grading, setting curbs, and crossings, flagging gutters, bow doring the roadway and constructing the necessary culverts, drains, and retaining walls, according to specifications on file in the office of the Board of Public Affairs. Thos. G. Smith, President.

BRIDGE.—Proposals will be received at the office of the county clerk at Cherry County, in Valentine, Neb., until August 18, for the construction of a bridge across the Niobrara River, about three miles north of Valentine. The bridge to be either one span of 96 feet or two spans of 48 feet each, floor of bridge to be 9 feet above low water mark, roadway to be 16 feet wide, no native timber to be used in the construction of the bridge except for cribs around piers and floor-plank; floor-plank to be three inches thick, and not less than 8 inches wide. Bidders to furnish plans and specifications. Geo. L. Fisher, County Clerk, Valentine, Neb.

HEATING AND WATER-SUPPLY.—Proposals for the heating and ventilation, new cell block, boiler stack, conduit and water-supply for the State House of Correction and Branch of State Prison in the Upper Peninsula, at Marquette, Mich., are invited by the Board of Commissioners of said House of Correction and Prison until August 24. Plans, specifications and instructions to bidders may be seen on and after July 23, 1887, at the office of the Commissioners, Marquette, and at the office of the architects, Scott & Co., 4 and 5 Wayne County Savings Bank buildings, Detroit, Mich. Proposals must be submitted separately for the heating and ventilation, cell block, conduit, boiler stack, and water-supply, and the Board of Commissioners reserve the right to reject any and all bids. For further information apply to the Secretary of the Board at Marquette, Mich. F. P. Royce, President of Board of Commissioners for the State House of Correction and Prison, Upper Peninsula.

BRIDGE on Agassiz Road, Back Bay, Boston, Mass. Until August 12. Address, The Park Commissioners, 87 Milk street, Boston, Mass.

WROUGHT IRON BRIDGES.—One bridge, 100 feet span, centre to centre of end piers; roadway, 12 feet in the clear; headway, 14 feet from floor to bottom of portal bracing; to be carried on two iron bents or stools 20 feet high; bents to rest on granite blocks 12 inches thick, and of sufficient size to support structure when loaded without settlement. One bridge, 150 feet span; roadway, 14 feet; headway, 14 feet; to be carried by two iron bents, same as

above, except that they shall be 25 feet high; or two spans of 80 feet each; roadway 12 feet in the clear; headway, 14 feet in the clear; to be carried by two iron bents, same as above, in place of stone abutment, and in centre to rest on two iron cylinders, properly braced, and filled in with concrete, one half cement. Until September 1. Address, W. G. Gammon, Chairman of Commissioners of Roads and Revenue, Floyd County, at Rome, Geo.

REPAIRING ARMORY.—Proposals for work to be done in repairing the Syracuse State Armory will be received by mail or in person up to August 16, at the State arsenal, Thirty-fifth Street and Seventh Avenue, New York City, at which time bids will be opened and declared. J. M. Variar, Chief of Ordnance.

GAS LAMPS.—Sealed proposals will be received August 11, at 12 M., for setting gas-lamps, posts, etc., on Evergreen Avenue, from Ralph Avenue to Grove Street, Brooklyn. Plans and specifications may be seen, and forms of proposals can be procured, on application at the Department of City Works. George Ricard Connor, Commissioner of the Department of City Works.

MONITOR.—Completion of the double-turreted monitor Miantonomah at the Navy Yard, New York. Until September 10th. Address William C. Whitney, Secretary of the Navy, Washington, D. C.

BRIDGE.—Proposals will be received until August 15, for building the superstructure of the proposed bridge across the Mississippi River at Franklin Avenue, Minneapolis. Andrew Rinker, City Engineer.

LEEVE WORK.—764,000 cubic yards of new work and 554,000 cubic yards of enlargement. Until September 12. Address the Board of Mississippi Levee Commissioners, S. W. Ferguson, Secretary, at Greenville, Miss.

LIGHTHOUSE TOWER.—Proposals will be received, until August 15, for furnishing complete the iron-work for tower-stairs at Moose Peak Light Station, Me., and stair railing for watch-room at Sankaty Head Light Station, Mass., in accordance with plans and specifications that may be seen upon application at this office. W. S. Stanton, Major of Engineers, U. S. A., Engineer 1st and 2d L. H. Dist., Room 142 Post Office Building, Boston.

BUILDING.—Proposals will be received by the Commissioners for the erection of a new court-house for Suffolk County, Mass., until August 12, for the erection of the northerly section of the new building from the second floor level. Plans and specifications can be obtained at the office of the architect, Pemberton Square. The right to reject all bids is reserved. S. B. Stebbins, Thomas J. Whidden, Godfrey Morse, Commissioners, Boston.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 258-259-260.

WATER. SEWERAGE, ETC.

MORRISVILLE, VT.—The town is trying to enter into an agreement with Warner & Sumnerville, of Waterbury, who own the Morrisville Water-Works, to supply water to ten hydrants.

FORT WAYNE, IND.—Plans and specifications have been prepared for obtaining a supply of water from artesian wells to lessen the water-famine now prevailing.

IMLAY CITY, MICH., is agitating for water-works.

WALNUT GROVE, ARIZ.—A company is building a dam across the Hassayampa River, at a cost of \$330,000, to store water for irrigation.

SANTA CRUZ, CAL.—An agitation for sewers has been begun.

DUNLAP, IOWA.—The town votes on the question of providing a water-supply at a cost of \$10,000.

PLATTSMOUTH, NEB.—A recent special city election to decide upon the raising of \$30,000 for the construction of sewers went very strongly in favor of the project.

COLUMBUS, KAN.—Messrs. Long & Doubleday are enlarging considerably their first plans for the water-works. Instead of putting up the 80-foot tower, they are putting up a stand-pipe which will tower heavenward 150 feet. They are constructing a reservoir 60 feet in diameter, in order to have an extra supply of water at their command in case of fire. They are putting in two pumps instead of one under the first plan, one of which will have a million-gallon capacity per day. They are putting in two big boilers instead of one. Besides these, other additions are being made to add to the efficiency of the works, which increase the cost of the machinery to the company, with no additional cost to the city or water consumer.

ORANGE, N. J., will use the Hyatt filter for its water supply; cost, about \$8,000.

SANFORD, FLA.—It is proposed to hold a town meeting to discuss the advisability of bonding the town for sewers and other improvements.

BRODHEAD, WIS.—Brodhead has granted an exclusive franchise to the Brodhead Hydraulic Company to use the streets for water-works for twenty-five years.

UNION GROVE, WIS., will have a water-supply from artesian wells.

TORONTO, ONT.—Superintendent Hamilton, of the water-works, has proposed an outline of two schemes for increased water-supply. One is to put a conduit pipe across the bay into the lake, erect new pumping engines, and build a reservoir; estimated cost, \$300,000. The other plan is to establish a new pumping station on the lake shore, with a new reservoir; the pumping engines to have a capacity of 16,000,000 gallons daily.

OROVILLE, CAL.—The Butte and Yuba Orange Irrigation Canal Company, organized at Oroville with \$1,000,000 capital, proposes to tap the main Feather River at the junction with the North Fork and take 100,000 inches of water through Yuba and Butte counties.

ST. CLOUD, MINN.—The City Council rejected all the bids recently submitted to construct water-works.

LINCOLN, ILL., needs a better water-supply.

TUSCUMBIA, ALA., wants water.

TUNICA, MISS., will have water from an artesian well.

TRENTON, N. J.—The City Engineer will make surveys and report on the outlet sewer.

KENT, O.—Judge Gilmer, of the Common Pleas Court, has granted an injunction restraining the Kent Water Company from using the water of Plum Creek. The suit was brought by manufacturers on Cuyahoga River, who feared injury to their water-power. It is said also that the Board of Health feared pollution of the stream by slaughter-houses, and were opposed to using the water of the creek.

WATER-WORKS will be constructed at Lewiston, Ill.; Washburn, Wis.; Hillsborough, N. H.; Olneyville, Ill.; Greensboro, N. C.; Yorkville, Ill.; Milledgeville, Ill.; Petersburg, Ill.

MILWAUKEE, WIS.—The \$60,000 that has been appropriated for the completion of the Memnonie intercepting sewer, on the south side, is deemed sufficient to finish it, and work will be pushed on it at once.

RACINE, WIS.—The Racine Water Company has increased the number of directors from three to six.

MOTT, SISKIYOU CO., CAL., is establishing water-works.

GREEN ISLAND, N. Y.—The contract for the construction of the sewers has been let to McGowan & Van Vranken for \$14,450.50, and the Sewer Commissioners have asked the village trustees to have bonds issued to the amount of \$50,000. The sewer-commissioners, August 2, decided that the issuing of bonds for \$17,500 for the new sewers would be sufficient.

WILLIMANTIC, CONN.—The report of the Sub-Committee on Sewerage contains an estimate of the cost of building them by Samuel M. Gray, of Providence, R. I. The estimate is \$177,155.

OCALA, FLA.—The City Council has contracted with W. A. Jeter to construct water-works and erect fifty hydrants. The work will cost \$70,000.

OAKLAND, FLA., will obtain water from an artesian well.

ALBION, N. Y.—Incorporated July 30 was the Albion Water-Works Company; capital, \$40,000. Charles R. Bassett, of Brooklyn, is one of the incorporators.

SANTA ROSA, CAL.—There is talk here of organizing a new water company.

NEWPORT, R. I.—The City Council has voted to submit to the people at the September election a proposition to appropriate \$8,000 for a soldiers' and sailors' monument, and laid on the table a proposition to submit to the people a proposition to appropriate \$33,000 for sewerage and paving of the principal business streets.

LOS ANGELES, CAL.—Rudolph Hering, C. E., of Chicago, has been engaged by the city to prepare plans for a sewerage system. City Surveyor Eaton has prepared an outline of what is needed, indicating a cost of \$2,000,000.

ALTOONA, PA.—City Council has voted an appropriation of \$29,000 to finish Kittanning reservoir, and \$4,000 for water-mains.

ALBANY, N. Y.—The Board of Contract has ordered specifications prepared for the Martinsville sewer, and work will soon be undertaken.

MEMPHIS, TENN., has entered into a contract with the Artesian Water Company for a supply of water from artesian wells, the city to pay for the first 100 hydrants \$80 each per annum; for second 100, \$70 each; for the third 100, \$60 each; and for all hydrants above 300, \$50 each per annum. The company is to erect and supply water to flush-tanks, the city paying \$15 per annum for each tank. The city will also pay for water for other purposes than hydrant supply and flushing \$3,000 per annum.

CHARLESTON, S. C.—The Charleston Water Company has bought land, and will construct reservoirs in the north-eastern part of the city. The supply will be from wells.

GRAND RAPIDS, MICH.—The committee on Water-Supply has reported, recommending that Mr. J. D. Cook, C. E., of Toledo, O., be appointed to prepare plans and direct the construction of the work, taking water from Grand River above the Soldiers' Home. It is proposed to obtain 10,000,000 gallons daily at a cost of \$1,000,000.

PEABODY, MASS.—The Water Board has notified the Salem board that all arrangements relating to a supply of water to the latter are annulled.

YUMA, ARIZ.—Articles of incorporation of the "South Gila Canal Company of Yuma County," have been filed in the office of the Recorder, capitalized at \$1,000,000. The articles of incorporation of the "South Gila Development Company" were filed at the same time, capital stock \$2,000,000. The incorporators of both companies are, Robert McPherson, W. E. Pope, and O. F. Thornton.

NORFOLK, VA.—G. W. Baker, of the Orange, N. J., Water Company, is preparing to submit an offer for the purchase of the city water works.

EAST LIVERPOOL, O., will have a popular election to decide on the question of raising \$30,000 for extensions of the water-supply.

CANTON, N. Y.—At a special election July 26, on the question of raising \$35,000 for sewers, the project was voted down by a large adverse majority.

COLORADO SPRINGS, COL.—Our correspondent writes: "Lowrie & Aulls, of Denver, Colorado, have been asked to prepare plans for a sewerage system."

SACRAMENTO, CAL.—An investigation of the water from the artesian wells has been made by Dr. W. F. Briggs, of the Improvement Association.

OAK CLIFF, TEX.—Our correspondent writes: "Company chartered under the name of the 'Oak Cliff Water-Supply Company,' capital authorized, \$50,000; subscribed capital, \$30,000. Have bought pumps and boilers and pipe and now putting up stand-pipe."

WATER-WORKS will be built in the following towns: Atlanta, Ill.; Lewiston, Kan.; Custer, O. (wells); Hebron, Neb.; Melrose, Minn.; Gladwin, Mich.; Belair, Md., cost \$2,000; Clinton, Mich.; Wellston, O.; Canton Falls, Minn.; Clinton, Ill.; Hillsboro, Ill.

SKANEATELES, N. Y.—Incorporated August 2 was the Skaneateles Water-Works Company, capital, \$40,000.

KALAMAZOO, MICH.—The committee on fire and water recommends the sinking of a new well for additional water-supply.

GOLDTHWAITE, TEX.—An artesian well will be sunk for a water-supply. Address J. M. Forehand.

FLORENCE, ALA.—The Cypress Water-Works Company has been organized.

OGDENSBURG, N. Y.—The city is considering the advisability of introducing a plant to filter the water, which is taken from the Oswegatchie River. Address the Superintendent of Water-Works.

CANTON, MASS.—The selectmen have called a special town meeting for next Wednesday evening, August 10, for the purpose of electing three persons to constitute a board of water-commissioners, also to see if the town will issue bonds.

DOWNS, KAN.—Our correspondent writes: "Our city has voted \$30,000 for water-works. No contracts have been let for the system that has been adopted—viz., stand-pipe. We desire first to negotiate the bonds."

ST. CLOUD, MINN.—C. E. Gray, of Fergus Falls, Minn.; Sykes & Phelps, Minneapolis, and H. P. Upham, of New Hampshire, are bidders for the water-works construction.

ST. PAUL.—Preparations for the laying of the water-main to connect the West Side with the general service have been begun by the firm of McRitchie & Nichol, of Chicago. The contract price is \$12,000, which calls for a 16-inch cast-iron pipe, to be laid from the foot of Broadway to the foot of State Street. A ditch or canal averaging four feet in depth will be dug in the river bed with a dredging boat.

LARAMIE CITY, WYO.—Our correspondent writes: "Messrs. Lowrie & Aulls, Civil Engineers, of Denver, Col., have just prepared plans for a \$75,000 sewerage system for this place."

CHICAGO.—In about three weeks, it is expected, proposals for the new pumping-engines and water-works tunnel will be advertised for.

WATER COMPANIES.—Incorporated are the Spring City, Pa., Water Company and the Rogers Ford, Pa., Water Company. Address D. S. Newhall, for both.

MONTGOMERY, ALA.—George A. Ellis, of Durham N. C., has been engaged by the city to construct a system of sewers.

WASHBURN, WIS., has awarded a contract for water-works to John Dickinson, of Chicago. The Holly system will be used.

LOUISVILLE, KY.—The Falls City Varnish Co. are building water-works; cost, \$10,000.

CANTON, DAK.—The Canton Improvement Company asks the city council for exclusive water-works franchise.

HUDSON, WIS.—The contract for building the engine-house for the water-works has been let to F. Fay, of New Richmond, and that for laying the pipes to Johnson & Son, Stillwater.

BARNETT, GEO.—The Bloomfield Water-Power Company has been incorporated. Capital stock, \$150,000.

DEERY, PA.—Water-works will be built. Address J. K. Russell.

PAWNEE CITY, NEB.—Address C. E. Casey in regard to water-works.

WESTFIELD, PA.—Messrs. Heermans & Lawrence, of Corning, N. Y., will build water-works at this place.

ATLANTA, ILL.—Water-works will be built by L. M. Hoblitt.

LOUP CITY, NEB.—Our correspondent writes: "Bids for water-works will be opened by A. A. Richardson, C. E., of Lincoln, Neb., at this place, at 12 o'clock noon, August 18 next."

DENVER, COL.—Our correspondent writes: "\$100,000 is to be spent in enlarging our sewerage system."

DENVER, COL.—The Health Board has sent a written request to the City Council to cause the construction of sewers.

ANDERSON, CAL.—A corporation has been formed at Anderson, to be known as the Anderson Improvement Company, with a capital of \$10,000. It has for its object the erection of warehouses, water-works and other improvements.

WEST LIBERTY, IOWA, will obtain a supply of water from artesian wells.

READING, PA.—The recent heavy rains demonstrated the need for sewers. Councils Committee on Sewers has therefore decided to recommend a special tax of two mills to raise \$50,000 for the purpose. It is proposed to construct five courses at an expense ranging from \$1,500 to \$30,000.

FLUSHING, L. I.—The contract for extending water-mains to the Government Post at Willet's Point has been let to Thomas Touhey, at \$7,475.

FORT WAYNE, IND.—The water-works trustees are considering methods of increasing the water-supply. Messrs Flemming and Bass, owners of most of the water privileges here, offered to sell the feeder and the feeder dam and all land necessary to the exclusive use of the water right for \$50,000, or would accept a rental of \$5,000 a year, or would supply and pump water, with water-power, at the same rate per million gallons the city paid at the time of the most economical workings of the system, if the city would provide two turbines and other appliances at a cost of about \$10,000, which was about half the cost of the proposed new engine.

TOPEKA, KAN.—Bids for construction of sewers in District No. 11 have been rejected, and new bids are advertised for.

OWENSBORO, KY.—Address the Owensboro Water Company in regard to improvements to be made in the works.

VISALIA, CAL., will spend \$12,000 for sewerage work.

FRESNO, CAL., needs sewers.

FORT FAIRFIELD, ME.—Fort Fairfield has accepted a charter of organization, and has voted to pay \$600 per annum for twenty years to any company that will put in water-works, and to exempt said company from taxation for ten years.

OTTAWA, KAN.—A strong effort is being made here to induce City Council to have plans prepared for a system of sewers.

GAS, STEAM, BUILDINGS, ETC.

HASTINGS, MINN.—A number of business men have met to consider the question of drilling a well for natural-gas. The matter has been referred to a committee, consisting of J. C. Meloy, J. D. Collinson, and M. V. Seymour, to investigate.

NAPA, CAL.—The city has granted a franchise to a company to light the streets with electric-lights.

MARQUETTE, MICH.—The streets will be lighted with electric-lamps.

MEMPHIS, TENN.—Legislative Council has made an agreement with the Equitable Gas Company, by which the latter acquires the right to lay mains, build works, and furnish gas at a price not exceeding \$2 per 1,000 cubic feet; twenty-five cents off for prompt payment.

CANASTOTA, N. Y.—The question of lighting the streets with electricity is being agitated.

NORTH LA CROSSE, WIS.—A gas company is being organized here.

PARIS, N. Y.—A movement is on foot to secure the lighting of the streets.

MARCY, N. Y.—G. M. Keplar, of the East Pennsylvania Oil and Gas Company, is making arrangements for the sinking of wells in this vicinity.

HARRISBURG, PA.—A company has been formed to bore for natural-gas near the city.

HYDE PARK, ILL.—The newly organized Hyde Park Electric-Light Company is preparing to erect plant to cost \$100,000.

CHATTANOOGA, TENN.—Natural-gas has been struck at the Logan well, located six miles from this city. A stock company has been formed, with a paid-up capital of \$20,000 to put down five more wells. If gas exists in paying quantities in this locality, Chattanooga is going to have it.

SYRACUSE, N. Y.—The Syracuse Gas-Light Company will make improvements, costing \$80,000.

DENVER, COL.—The Underground Electric Conduit and Water-Pipe Company has contracted with the Denver Electric Light, Heat and Power Company for two miles of mains which will run from the works to Seventeenth Street and then to Broadway. Laterals will be run wherever necessary. The work is to be completed in about sixty days.

POMONA, CAL., will have gas-works built.

OAKLAND, CAL.—The Pacific Coast Electrical Construction Company has filed articles with the County Clerk.

SOMERSET, KY.—A natural-gas company has been organized. E. V. Bentley, of Wilmington, O., is president. The capital stock is \$250,000.

FORT WAYNE, IND.—Messrs. W. W. Worthington and R. C. Bell have submitted to the Business Men's Exchange a proposition looking to piping natural-gas to that city, as follows: "If a company should be found to pipe gas to Fort Wayne from our field, with a stock capital of \$200,000 paid up, we will put down in this territory, at our own expense wells sufficient to furnish thirty million feet of gas per day, convey to such company our leases for the territory where the wells are situated. We will also furnish the right of way for pipes from the wells to the corporate limits of the city, this company to lay the necessary pipes, and we will take in payment therefor ten thousand dollars (\$10,000) in money and one hundred thousand dollars in the capital stock of such company. This proposition shall remain open for acceptance for the next sixty days only.—W. W. Worthington, R. C. Bell."

RAILROADS, BRIDGES, CANALS.

HARRISBURG, PA.—Bids for paving Third Street with asphalt have been rejected.

NEWPORT, KY.—The Central Railway Bridge Company is soliciting permission to establish approaches for a bridge over the Ohio to Cincinnati. According to plans it will be a cantilever, 2,987 feet long.

PLATTSBROUGH, N. B.—At a recent special election a proposition to raise \$10,000 for paving the outer sections of the city was carried by a large majority.

JERSEY CITY, N. J.—The Pennsylvania Railroad Company has filed plans with the Board of Public Works for the proposed elevated railroad structure for their trains.

BRIDGEPORT, CONN.—The Board of Aldermen has accepted the report of the Board of Public Works in relation to a new iron draw and bridge in place of what is known as the Lower Bridge, and have voted to appropriate \$80,000 therefor.

TRENTON, N. J.—Justice Bradley, of the U. S. Supreme Court, has decided that the State of New Jersey has no power to prevent the construction of the bridge over Arthur Kill, between the State of New Jersey and Staten Island. The work is going forward rapidly.

DENVER, COL.—The Board of Aldermen have passed an ordinance providing for the building of the Nineteenth Street bridge at a cost of \$35,000.

HARRISBURG, PA.—A charter has been granted to the Penn Bridge Company, of Beaver Falls; capital \$10,000.

COHOKS, N. Y.—The Water Board has granted a contract for three iron bridges to the Canton Bridge Company at \$1,650.

RAILROAD.—The appraising of land for the railroad from Locust Valley to Oyster Bay, L. I., is about completed, and it is expected the Long Island Railroad Company will soon begin work on the line.

ERIE CANAL.—The Canal Convention at Rochester, N. Y., last week passed resolutions favoring the Seymour plan of lengthening locks and increasing the depth to seven feet. There is appropriated by the State over \$500,000 for work on the canal in 1887.

UNION SPRINGS, ALA.—Address T. H. Mabson in regard to a street railway here.

OMAHA, NEB.—Hopkins & Scully, of St. Louis, contractors for the bridge over the Mississippi River, will begin work at once.

Advertisements for the paving of Broadway will be published at once.

BRIDGE.—The Hamilton, Ont., Bridge Company has been given a contract for an iron bridge over the River Thames, between the counties of Elgin and Middlesex, Canada.

NEW YORK CITY.—Work has begun under direction of Colonel Walter McFarland, U. S. Engineer, on the improvement of the Harlem River and Spuyten Duyvil Ship Canal. No proposals will be issued until definite information as to the character of the excavation is obtained.

MENOMINEE, MICH.—A city election will be held August 8 for the consideration of bonding the city \$50,000 to assist the building of a bridge across the Menominee River. On August 19 Marinette, Wis., holds an election for the same purpose.

AUSTIN, MINN.—The County Commissioners have decided to build three iron bridges; total cost, \$7,800. Bids for piping the new water-mains have been advertised for.

TORONTO, ONT.—The City Engineer has presented his estimate of the cost of paving Jarvis Street, placing it at \$70,000. The report was adopted by Council.

PUEBLO, COL.—Our correspondent writes that \$31,000 worth of bridges are to be built here after plans by Messrs. Lowrie & Aulls, of Denver, Colorado. One bridge is to have a 40-foot roadway and 160-foot spans.

BRIDGE.—The Chicago, Burlington and Quincy Railroad has closed a contract with the Union Pacific Bridge Works for another bridge across the Missouri below their own bridge at Plattsmouth, Neb., to connect their Red Oak and Hamburg division with the line from the river at Nebraska city through Lincoln. The line now runs eleven miles up the river to East Nebraska City, directly opposite, but a cut-off will probably be built from Shenandoah through Sydney to the river. It is reported that committees have been appointed to arrange terms of consolidation for this company with the Chicago, Burlington and Northern.

DUBUQUE, IOWA.—The C. B. & N. R. R. are contemplating the building of a \$20,000 railroad bridge. Major Mackenzie, Corps of Engineers, U. S. A., with other engineers are now looking into the question of location.

BIDS OPENED.

AKRON, O.—The following bids for steam-fitting and plumbing for Summit County Infirmary were received by the County Commissioners July 27:

D. F. Morgan, Akron, O., boilers separate, \$990; total, \$3,500.

John Robb, Akron, O., boilers separate, \$985; total, \$3,300.

L. Biggs, East Akron, O., boilers alone, \$988; only figured on boilers.

BOSTON, MASS.—The Boston Water Board received the following proposals on Wednesday: For two iron sluice-gates, 42 1/2 feet, the Whittier Machine Company bid \$740, and the Coffin Valve Company \$500 each; for six iron sluice-gates, 32 1/2 feet, the Whittier Machine Company bid \$600, and the Coffin Valve Company \$295 each; for two iron sluice-gates, the Whittier Machine Company bid \$452, and the Coffin Valve Company \$245 each; for one iron sluice-gate, 2 feet 6 inches by 2 feet 6 inches, the bid of the Whittier Machine Company was \$210, and that of the Coffin Valve Company \$95; for one iron floor at the Chestnut Hill pumping station the Whittier Machine Company bid \$290, and the Coffin Valve Company \$202; for seven 20-inch stop-cocks the Whittier Machine Company bid \$255, and the Coffin Valve Company \$400 each; for six 24-inch stop-cocks the Whittier Machine Company bid \$260, and the Coffin Valve Company \$300 each; for six 30-inch stop-cocks the Whittier Machine Company bid \$195, and the Coffin Valve Company \$200 each; for two 24-inch check-valves the Whittier Machine Company bid \$485, and the Coffin Valve Company \$525 each. The total bid of the Whittier Machine Company was \$14,017, and the Coffin Valve Company \$10,717. The contract was awarded to the latter.

CHICAGO.—Bids were opened August 2 for the electric light plant for the Chicago River. The specifications called for dynamos, lamp fixtures, six miles of wire, and the necessary power to be located in a building at the north-west corner of Washington and Clinton Streets. One hundred double carbon American arc lights of 2,000 candle-power each were specified. There were several bids and the plant will cost less than Professor Barrett's estimate, although the cable will cost rather more. Cowl & Van Denberg offered to furnish the dynamos for \$6,500; S. S. Badger, dynamos, \$7,457. The Chicago Arc Light and Power Company offered to furnish the complete outfit for \$35,000, including power, dynamos, etc., etc. This company also offered to rent the lights at 45 cents per lamp per night, winter and summer. This is thought to be cheaper than any previous offer, and is better than the city's contracts with the gas companies. The United States Electric Company offers the cables at \$14,575. The Fort Wayne Jenny Electric Light Company offered the complete plant, according to the full specifications, at \$35,500. The Brush Electric Company made bids on the dynamos and cables, with three different systems, aggregating respectively \$12,847, \$13,182, and \$13,560. The Western Electric Company offered the plant, exclusive of the circuit, for \$11,045. The Ball Electric Light Company, of New York, offered the cables for \$14,200.

VALPARAISO, NEB.—The following bidders have been awarded contracts in connection with the construction of the water-works: National Tube Works Co., New York, and McKeesport, Pa., pipe and specials, \$3,460; Nebraska Planning Mill Co., Lincoln, Neb., tank, \$673.50; B. S. Clerk, Ashland, Neb., excavating and laying pipe and furnishing drydriants, valves, etc., \$1,350. The city builds its own house and furnishes machinery.

BALTIMORE, MD.—The Northern Central Railway Company have awarded contracts for building new piers and warehouses at Canton to cost nearly \$200,000. The present piers (3 and 4) are to be extended back 700 feet to Clinton Street, where they will end in a bulkhead. The total length when finished will be about 1,500 feet. To extend the piers 700 feet back, that length will be dredged to a depth of twenty-seven feet and 150 feet wide. A large warehouse will be built north of No. 2 elevator 270 feet long, seventy feet wide and three stories high. Andrew Brown and J. F. Adams have been awarded the contract for building the piers, the American Dredging Company, of Philadelphia, the dredging, and Jones & Henner the warehouse and shedding.

NEW YORK CITY.—The Aqueduct Commissioners awarded, August 3, the contract for building shafts 20 and 22 to Caldwell, Wilcox & Co. The contract for building the gatehouse and blow-off at Ardeley was given to O'Brien & Clark at \$4,900.

HAGERSTOWN, MD.—The contract for steel cells for Washington County Jail has been given to the Pauly Jail Building and Manufacturing Company, of St. Louis, at \$7,000.

ROCHESTER, N. Y.—Contracts have been awarded by the Executive Board as follows: Ray Street stone sewer, William Fuller, \$13,079.90, estimate, \$15,000; Hawley and Seward Streets pipe sewer, William Howe, \$2,115.25, estimate, \$2,500.

BOSTON.—Proposals for furnishing the dressed granite required to complete the main building of the new court-house were opened August 2 by the commissioners. The contract has not yet been awarded, and will probably not be announced for a few days. It is estimated that about 140,000 cubic feet of granite will be required for the purpose. The bids are as follows: Granite Railway Company, \$347,700; Sweat & Davis, \$335,000; Halliwell Granite Company, \$325,642; Mt. Waldo Granite Company, \$317,500; Cape Ann Granite Company, \$313,195; Davis Tillson, \$305,500.

ALLENTOWN, PA.—The Board of Water Commissioners awarded contracts August 2 for work required to construct the new water-works at the Fountain House. For building the stack the bidders were Tighman, Ochs & Son, who offered to do the work for \$2,179.22, and Leonard Seifing, whose figure was \$3,500. The contract was awarded to Ochs & Son.

R. D. Wood & Co., of Philadelphia, proposed to furnish 2,700 feet of twenty-inch supply-pipe at the rate of \$55.20 per ton, delivered at Allentown. The firm being the only bidder, the contract was awarded to them. To furnish and erect two steam-boilers of eighty horse-power each, there were three bidders, as follows: Knowles Steam Pump Company, of New York, \$3,597.75; Tippet & Wood, of Philadelphia, N. J., \$3,100; Abel Heilman, of Allentown, \$3,201.66. The contract was awarded to Mr. Heilman.

BROOKLYN.—Two proposals have been sent in for the establishment of a laundry in the female prison of the county jail by Gateson & Son, for \$80, and by Charles E. Hartshorn, Jr., for \$68. Three proposals were handed in for certain alterations to the boilers and heating apparatus in the jail, as follows: Peter J. Donohue & Son for \$1,060; Lawrence Tivey for \$1,020; Felix Campbell for \$980. All proposals were referred to the Committee on Contracts for examination and report.

PHILADELPHIA.—Director of Public Works Wagner has awarded the contract for covering the bottom of the south division of the new East Park Reservoir and the inside slopes of embankment to within 20 feet of the top with a coating of concrete 5 inches in thickness, and from thence to top of the slopes with bricks laid on edge in cement 2 inches thick. The bottom containing 10,723 square yards, and the slopes 14,208 square yards; and also for lining entire reservoir with brick embedded in cement. The bidders were Harry McTague, \$1.23 per square yard for the concrete lining and \$2.30 per square yard for the brick lining; John M. Mack, \$1.15 for concrete and \$2.60 for brick; Charles H. Large & G. Paist, \$1.23 for concrete and \$1.66 for brick; Charles J. Kennedy, \$1.80 for concrete and \$2.20 for brick; Louis Grant, of Pottsville, \$1.90 for concrete and \$1.20 for brick; Vulcanite Paving Company bid \$1.33 and \$1.43 per square yard for concrete and \$1.31 and \$1.43 for brick. Louis Grant, of Pottsville, was awarded the contract, the total cost of which will be about \$57,000.

CLYDE, N. Y.—Bids for laying a vitrified pipe sewer were opened by James Shanahan, State Superintendent of Public Works, August 3, as follows: James Robinson of Rochester, \$1,206.30; Matthew Dillon, of Rochester, \$1,665.80. The contract was awarded to Robinson.

GOVERNMENT WORK.

WASHINGTON, D. C.—Bids were opened at the Navy Department July 30 for the purchase of condemned vessels. The following are the highest amounts offered:

Burdette Pond, Meriden, Conn., \$18,255 for the Powhattan; Thomas Butler & Co., Boston, Mass., \$15,900 for the Ticonderoga; W. T. Garrett, San Francisco, \$18,002 for the Shenandoah; \$18,003 for the Lackawanna; \$16,501 for the Wachusett; W. E. Mighell, San Francisco, \$4,520 for the Cyane. There was no bid for the Tennessee. All the bids are above the appraised value of the vessels.

WASHINGTON, D. C.—Bids were opened at Colonel Thomas Casey's office August 3 for furnishing and erecting iron-work for fence and gates, and court-yard stairs for the west wing of the State, War, and Navy Department building as follows: Becham & Middleton, of Washington, \$1,515; Champion Iron Fence Company, of Kenton, Ohio, \$1,112; Poulson & Eger, of Brooklyn, \$3,650; George White & Sons, of Washington, \$1,800; Manly and Cooper Manufacturing Company, of Philadelphia, \$1,336, and Charles White & Co., of Washington, \$1,748. The contract will probably be awarded to the Champion Fence Company, the lowest bidders.

JAMES RIVER, VA.—Col. W. P. Craighall, U. S. Engineer, has presented his report on the James River Improvement. He says the width to be given to the channel is 400 feet from the sea to City Point, 300 feet from City Point to Drewry's Bluff, and 200 feet from thence to Richmond. Work on the project will be suspended in December next. It is estimated that \$4,386,070.45 will be required to complete the work, of which \$400,000 can be profitably expended during the next fiscal year. There is now available for the continuance of the work until December \$101,942.12. Col. Craighall's report incloses a statement from C. P. E. Burghwyn, who has charge of the James River improvement. He states that frequent complaints had been made of vessels grounding at Kingsland Reach, and a careful survey was made of the locality, which revealed the fact that the dredge channel had been filled. Bids to restore channel were called for, and the contract subsequently awarded to James Caler & Sons, who abandoned the work after excavating 653 cubic yards. The contract was then turned over to George E. Ward, who removed 18,017 cubic yards of sand, 54 boulders, 15 logs, and some wreckage.

HARBOR WORK.—Captain C. W. Palfrey, U. S. Engineer, has made his report to the Secretary of War on the improvement of Lake Ontario harbors. For Oswego harbor, he recommends the maintenance of the existing west breakwaters, the removal of the east breakwater and the building of one spur crib 150 feet in length. He estimates the expenditure during the next fiscal year for repairs at \$45,000; for spur crib, \$30,000; for removal of east breakwater, \$15,000; for contingencies, \$18,000. He recommends the maintenance of the existing works and channel at Little Sodus Bay, N. Y., and submits estimates of \$20,000 for repairs and \$4,000 for contingencies. For Great Sodus Bay, N. Y., Captain Palfrey recommends the maintenance of existing works, and the dredging of the entire space between the piers to hard bottom, and thereafter the dredging of a channel 200 feet wide and 15 feet deep at entrance low water. He submits estimates of \$27,500 for repairs, \$30,000 for dredging, and \$11,500 for contingencies. He recommends for Charlotte, N. Y., the maintenance of existing piers, removal of decayed guide poles, and dredging to fifteen feet at extreme low water, both between piers and across the outer bay. He estimates that \$67,800 can be profitably expended in this work during the next fiscal year.

CHICAGO.—Major Hanbury, of the Engineer Corps, U. S. A., has presented his report to the Secretary of War on the harbors in his territory. He says that some of the breakwaters of Chicago harbor should be rebuilt of stone in place of the present wood. At Calumet harbor about \$20,400 will be required to complete the improvement. He advocates a large outlay on the Illinois River improvements.

ABSTRACT of proposals received and opened by Major Thos. H. Hanbury, Corps of Engineers, U. S. A., at Chicago, Ill., July 29, for dredging in the Calumet River between the Forks and one half-mile east of Hammond, Ind.:

Robert Finch, Grand Haven, Mich., 25 cents per cubic yard.

Green's Dredging Co., Chicago, Ill., 35 cents per cubic yard.

Samuel O. Dixon, Racine, Wis., 11 cents per cubic yard.

F. R. Crane, Chicago, Ill., 21 cents per cubic yard.

Dodge & Petrie, Chicago, Ill., 23 1/4 cents per cubic yard.

POTOMAC FLATS IMPROVEMENT.—Colonel P. C. Hains, in charge of the Potomac Flats Improvement at Washington, reports that the work already done has benefited the health of the city, and that the continuance of the work will be of still greater benefit to the city's sanitary condition. He recommends an appropriation of \$600,000 to continue the work. He also suggests the entire remodeling of Long Bridge and calls attention to the almost useless conditions of Forts Washington and Foote.

SYNOPSIS of bids for iron-work of the roof, attic floor-beams, etc., for Court-house, etc., Leavenworth, Kan., opened by Supervising Architect July 28, 1887: A. J. Tullock & Co., \$9,150; Haugh Ketcham & Co. Iron-Works, \$11,500.

DRY-DOCKS.—The contract for the timber dry-docks at the Brooklyn and Norfolk Navy Yards has been given to Sampson & Co. at \$1,061,000. The docks will be 500 feet long. We have already published the bids.

SYNOPSIS of bids for carpentry work, roof, sheathing of floors, hardware, etc., for Post-Office, etc., at Lexington, Ky., opened by Supervising Architect August 1: Harris & Co., Newport, Ky., \$8,027; George Clark, Lexington, Ky., \$7,839; John Mitchell, Louisville, Ky., \$9,145.

SYNOPSIS of bids for fire-proof safes, as follows, opened July 30, by the Supervising Architect:

Fire-proof safe, with burglar proof chest, for Deputy Collector's Office, St. Paul, Minn.—Hall Safe and Lock Co., \$340; Miles & Hale (No. 32 Detroit Safe), \$348; Miles & Hale (No. 33 Detroit Safe), \$395; Mosler, Bowen & Co., \$366.

For Post-Office, Greensborough, N. C.—Mosler, Bowen & Co., \$353.36; Marvin Safe Co., \$355; Farrell & Co., \$556.

For Assistant Treasurer's Office, Boston, Mass.—Mosler, Bowen & Co., \$177.50; Farrell & Co., \$286; Damon Safe and Iron Works Co., \$290; Marvin Safe Co., \$198.

For Deputy Collector's office, at New York.—Mosler, Bowen & Co., \$662.50; Farrell & Co., \$675; Marvin Safe Co., \$550; Herring & Co., \$975.

For U. S. Government Building, at Norfolk, Va.—Mosler, Bowen & Co., \$450.72; Marvin Safe Co., \$563; Farrell & Co., \$738.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 11. } PUBLISHED EVERY SATURDAY.

NEW YORK, AUGUST 13, 1887.

LONDON, AUGUST 27, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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MASSACHUSETTS WATER-SUPPLY.

PERHAPS the most important duties imposed upon the reorganized State Board of Health of Massachusetts are those provided for by the "Act to protect the purity of inland waters," passed in 1886, on the recommendation of the Massachusetts Drainage Commission and giving the Board supervision of the water-supplies and sewage disposal of the cities and towns of the State.

The first report of the new board, now before us, is of special interest as indicating the course which it will probably pursue in regard to this exceedingly important subject. Its first step is a wise one; it has organized an engineering department, consisting of Joseph P. Davis, consulting engineer; F. P. Stearns, chief engineer, and X. H. Goodnough, assistant. The report states briefly the questions already submitted, including the sewerage of Medfield, Winthrop, Taunton, and other towns, and the water-supply of Bradford and Boston.

Speaking of the Merrimac River water, it is noted that "in 1873 the impurities added by the sewage of Lowell were so modified by dilution and by a flow of nine miles that the water at Lawrence above the city was, according to chemical analysis, as good as that above Lowell, but that in 1886, with substantially the same quantity of water flowing in the river, the percentage of impurities, as shown by the albuminoid ammonia, has increased above Lowell by 36 per cent. and above Lawrence by 57 per cent., and that the impurities poured into the river at Lowell are now greater than the exposure to the air in flowing nine miles and the increased dilution can overcome, leaving the water above Lawrence with 12 per cent. more of impurities, due to animal and vegetable putrefaction, than that above Lowell, and 57 per cent. more than it contained when the water-works were established at Lawrence, and now approximating the undetermined border line beyond which the water would be unfit for drinking." This is a striking proof that it is full time that the State took some action in regard to these matters. As the Board remarks: "A gradually increasing mass of pollution suddenly reaches a point at which the stream is no longer able to neutralize it, either by dilution or by any of the so-called processes of oxidation, and a condition of things may be arrived at as disgusting as that of the Blackstone at Millbury, or of Alewife Brook in Cambridge and Somerville, or of the North River at Salem." In no one of these instances was the introduction of sewage a nuisance originally, and in no one of them would it have been possible to say in advance just where the saturation point would be reached.

In addition to the proposed systematic analyses of water-supplies throughout the year, which has already been noticed in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, the board proposes to make a series of investigations on the disposal of sewage by irrigation to obtain definite knowledge as to the area of land required for this purpose, and the results can hardly fail to be of great practical interest and importance.

LONDON SEWAGE DISPOSAL.

THE Metropolitan Board of Works is making extensive and costly preparations for treating the sewage of London by a chemical precipitation process, and for disposing of the resulting

sludge by carrying it beyond the Nore in ships specially constructed for that purpose and dumping it into the sea. These works are intended to have an ultimate capacity for treating about 150,000,000 gallons of sewage per day, the product of about five millions of people. The amount of sludge to be disposed of daily is reckoned at between three and four thousand tons, and each ship is to have a capacity for 1,000 tons.

The chemical process to be used was described by Mr. W. J. Dibdin in a paper read before the Institution of Civil Engineers in January last, and consists essentially in the use of lime and sulphate of iron. At the same time a paper was read by Mr. W. S. Crimp on "Filter-Presses for the Treatment of Sewage," in which he took the ground that such machines solve the question of sludge disposal in sewage-precipitation works, and that the manure thus produced is equal, if not superior, to farm-yard manure.

The reading of these papers was followed by a long discussion, in which they were sharply criticised.

The *Builder* comments editorially upon this as follows:

"The essential point, to the inhabitants of London and to those interested in the commerce of the Thames, of what is to be effected by the present scheme of the Board of Works for the purification of the river, was, however, almost entirely blinked by the various speakers. Mr. Dibdin stated that the average London sewage at the outfalls contains 87 grains of foreign matter in the gallon, of which 27 grains are in a state of suspension and 60 grains in a state of solution. Assuming this to be the case, it follows, from the well-known analyses of which we have a large supply, that some 15 grains of suspended matter must either have been dissolved during the run of the sewers, appearing at the outfall in solution instead of in suspension, or that about the same approximate quantity had been deposited in the sewers by the way. The latter supposition is in accordance with the evidence, brought before the Committee on the Drainage of the Houses of Parliament, as to the cost and nuisance involved in clearing out the Metropolitan sewers by hand.

'Of yet more urgent importance is the question, What is the character of the effluent to be delivered into the Thames after the treatment now proposed? It is extraordinary to find no statement of this important feature of the case. Over the broad average of those cases of which the analyses are accessible, the mean result of the various modes of treatment employed has been the removal of about nine-tenths of the matter in suspension, accompanied by an increase of the matter in solution. If this rule applies to the London sewage, as described by Mr. Dibdin, the result of the precipitating process will not very materially benefit the Thames. That the difficulty of dealing with dissolved impurities is far greater than that which occurs as to suspended matter, is evident from Mr. Dibdin's table, which shows the different effects of the same dose of lime applied to, as far as appears, the same kind of sewage. This is shown to remove, in one instance, two per cent., and in another twenty-six per cent., of oxidizable matter in solution. With such wide differences, not as stated by opposing authorities, but in the same table, it is evident that all discussion is entirely in the air without some definite statement as to the effluent actually produced by the process which throws down 4,620 tons of sludge per day, although removing only 337 tons of dry foreign matter from the sewage.

"To another point of primary importance an equal want of due attention was betrayed in the debate—that is, the secondary action of any such admixture of lime and salts of

iron as is now proposed by Mr. Dibdin. As to this there is ample evidence. Mr. Latham stated in the debate that 'at Northampton iron salts were used in the proportion of $4\frac{1}{2}$ grains per gallon to 15 or 16 grains of lime, with the result that the river was as foul after treatment as before. The sewage at the outfall-works was made to appear clear, and the river seemed to be inoffensive; but after it had flowed a short distance, it began to turn, and was soon as black as ink, one putrefying mass.' Nor is this experience confined to Northampton, or to the action of either persalt or sub-salt of iron on lime. At Bradford, at Clifton, and at Cheltenham the same thing has occurred, chloride of iron being used in some instances, and sulphate of iron in others. That a small quantity of lime in solution may be more effective than a much larger quantity in suspension is not a new discovery. Whether Mr. Dibdin has or has not allowed enough is a matter that will have to be brought to the test, not of opinion, but of fact. But that reaction of a most offensive nature may take place when small quantities of lime are used with apparently good results at first, is indisputable. At Hertford the exact quantity per gallon now proposed by Mr. Dibdin was applied to a very weak sewage. The result was that the effluent contained absolutely more foreign matter per

nitide and importance, and it is, therefore, not surprising that we find eminent men in both professions arrayed on opposite sides, it certainly seems as if the main point in the above criticism of the *Builder* is well taken—namely, that sufficient evidence has not been collected as to the influence which the outfall from the works will have on the River Thames, which is, after all, the great point of interest.

WATER-SUPPLY FOR WATCH HILL, R. I.

WATCH HILL, R. I., has natural advantages and attractions possessed by few summer resorts on the Atlantic coast. We are glad, therefore, to note in the *New York Tribune* that a proposition to extend the water-mains from Westerly is under consideration, so that for a water-supply wells and cisterns need no longer be relied on. Where other sources are impracticable of attainment these may be tolerated, but they are always attended by the element of danger—contamination. The Watch Hill hotel proprietors and cottage owners should therefore promptly avail themselves of this opportunity to eliminate it.

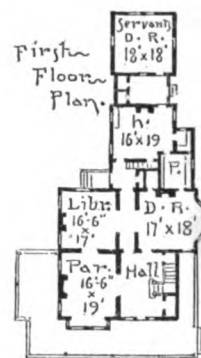
In explanation, it is stated that the peculiar work for which the pump is intended is pumping water from an un-worked colliery direct into the main, the special action of the Worthington permitting a regular flow of water without undue pulsations in the main.

A new system of timber drying (Jennings') is in operation at Liverpool. Air is conducted over red-hot pipes until the moisture is evaporated, after which it is driven, at a temperature of 75° Fah., into the chamber containing the timber. There is a constant current of the dried air, which is operated on by the furnace again and again, until the moisture is extracted from the timber. There is, of course, no desiccation of the timber by the process.

The "Great Eastern" steamship, which was originally destined to perform such wonders, is becoming a nightmare to Harbor Boards. It was proposed two years since to take the leviathan to New Orleans during the World's Fair, and make a floating hotel of her, but the contract fell through. Since that time she has been on exhibition by a firm of Liverpool drapers on the Mersey, but after breaking her moorings and doing some damage, the Liverpool



A HOUSE AT MORRISTOWN, N. J.—GEORGE E. HARNEY, ARCHITECT.



gallon than the original sewage, and that an abominable nuisance was created lower down the river, at Ware.

"What public opinion will expect of the Metropolitan Board of Public Works, before they make any further heavy demand on the ratepayers, we take to be this: first, to explain what effluent they propose to turn into the Thames; and secondly, to show what proof they adduce that the proposed treatment will not, by the secondary action of lime and iron, leave the river nearly as foul as it was before. If we take the figures cited by Mr. Dibdin, 13 per cent. of 20 grains, that is to say 2.6 grains, of dissolved organic matter will be removed from the sewage by the proposed process; add to this 90 per cent. of the total suspended matter, which comes to 24.3 grains, and we find that, from a total of 87 grains of impurity, 26.9 grains will be removed, leaving the effluent charged with 60.1 grains of foreign matter, plus so much of the 4.7 grains of precipitant as have not been thrown down. If that be the case, the effluent will still be much fouler than the sewage which, in many towns, has been found to be intolerably offensive. And there remains the question, why will such an admixture of lime and salts of iron as has been found to produce an intolerable nuisance wherever put in practice hitherto, prove innocuous in the Thames?"

While it cannot be expected that there should be agreement between chemists and engineers as to the best means of dealing with a problem involving so many conditions and of such mag-

OUR BRITISH CORRESPONDENCE.

Congratulatory Memorial to Mr. Thomas Hawksley—The Worthington Pump in the English Market—New System of Timber-Drying—The Steamship "Great Eastern."

LONDON, July 20, 1887.

A COMMITTEE has been formed, with Sir Frederick Bramwell as Chairman and Dr. W. Pole as Secretary, for the purpose of presenting Mr. Thomas Hawksley, the well-known hydraulic engineer, with his portrait and a congratulatory memorial on his attaining his eightieth birthday. A party of gentlemen, headed by the Attorney General, waited upon him on Tuesday, the 13th inst., complimenting him upon his useful labors and congratulating him on his continuous health.

THE Worthington pump is again to the fore, causing trouble as an interloper in the English market. It will be remembered that there was considerable discussion respecting the Soudan contracts for these pumps. During the recent drought in Swansea, a special Worthington pump was cabled for from America, the fact arousing considerable interest on the part of English pump

Harbor authorities, after considerable trouble, got her to "move on," and she is now on the Clyde at Glasgow. It remains to be seen how long the Scots will tolerate her. Possibly not long if she does the proverbial "saxpence" of damage.

SAFETY-VALVE.

OUR SPECIAL ILLUSTRATION.

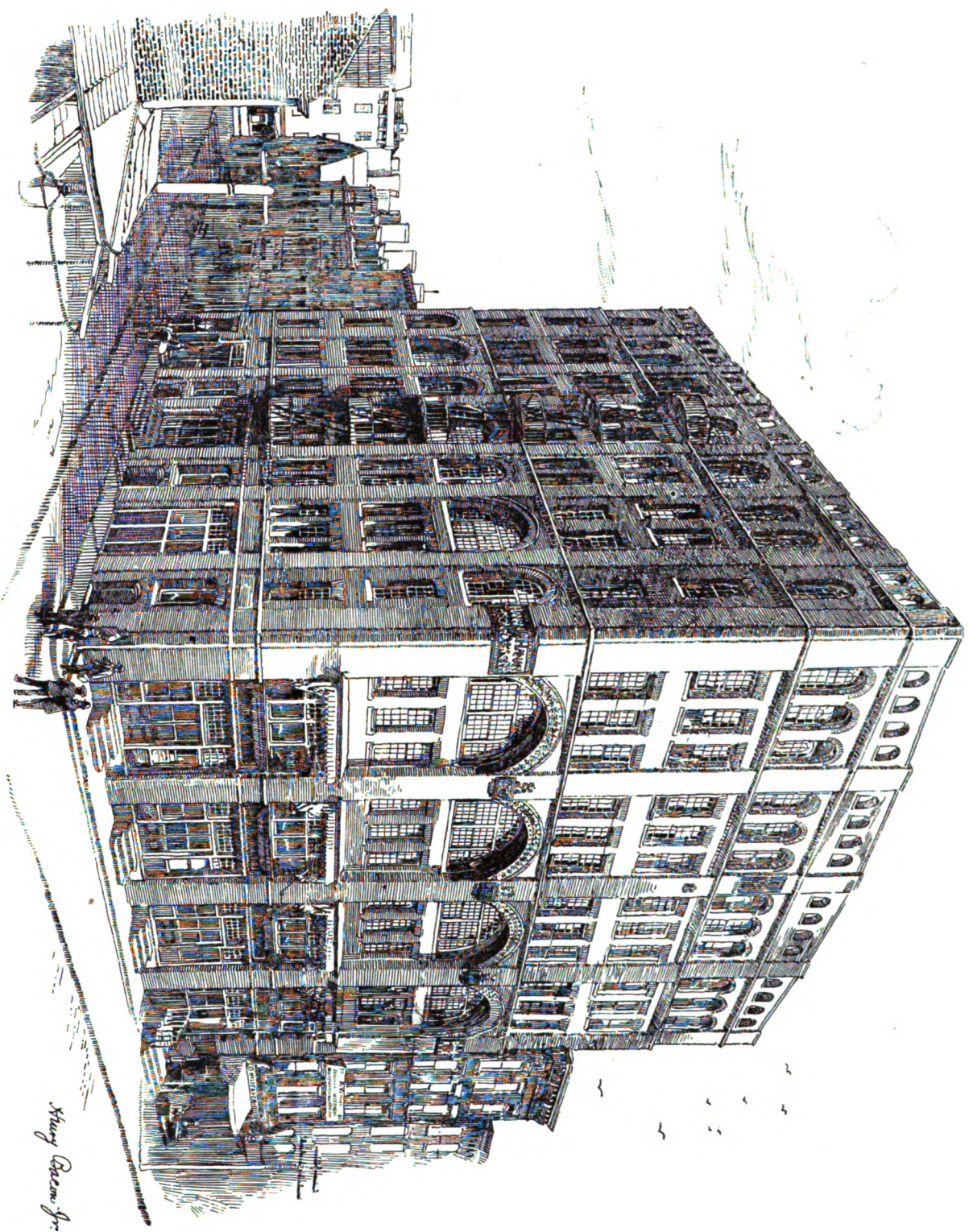
HANAN & SON'S SHOE FACTORY, NEW YORK.—BABB, COOK & WILLARD, ARCHITECTS.

THE subject of our special illustration this week is Hanan & Son's Shoe Factory, corner of Centre and White Streets, New York City. It is built of brick. Babb, Cook & Willard, of New York, are the architects.

OUR VIGNETTE ILLUSTRATION.

A HOUSE AT MORRISTOWN, N. J.

OUR vignette illustration is of a house at Morristown, N. J. It is built of wood, filled in with brick, covered with clapboards the first story, and shingles above; slate roof, stone foundation. Main hall finished in ash, other portion of house pine, painted. Parlor ivory-white. Cost, about \$10,000. The architect was Mr. George E. Harney, of New York.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HANAN & SON'S SHOE FACTORY, NEW YORK.

BABB, COOK & WILLARD, NEW YORK, ARCHITECTS.



THE NEW CROTON AQUEDUCT.

No. XIV.

(Continued from page 41.)

TIPPLE FOR DUMPING CARS.

A TIPPLE is a mechanical device designed to secure facility in dumping the contents of "tunnel cars" (when loaded with stone and debris) from an elevated platform into "dump-cars" located under it for receiving such material. The form of tippie now to be described is in use at shafts Nos. 22 and 23 of the new Croton Aqueduct, and also at shaft 18½, though slightly modified in form. At shafts 22 and 23 there are two styles of cars in use, the larger one, or "dump-car," holding 2½ cubic yards, intended for transferring material received at head-house from tunnel excavation to the dump or spoil-bank. This car is run on a track having three feet gauge and drawn by mules. The small or "tunnel" car will hold one cubic yard, and is filled with stone and debris at points in the tunnel where material excavated may require, drawn also by mules on a track of two-feet gauge to the foot of shaft, then elevated to head-house by means of a cage and delivered at the elevated platform, thence run on the tippie by two men who dump the contents into the dump-car as illustrated in Fig. 1, located under the platform for that purpose. When the car is run in position on the tippie portion of the platform, two hooks suspended from a windlass by ropes are inserted into openings made for that purpose in the end board of the tunnel car; this windlass is then turned by hand-power, which draws the board up out of the way. A chain, shown in Fig. 2 at *c*, is hooked into an eye set in the frame of car at rear end, bolt *c* moved back, then the car can be easily tipped and contents deposited into dump-car below.

Figure 1 is a general view of head-house over shaft and platform, showing position of small car when contents are being dumped into the large car standing on the track below the platform. A similar platform and tippie is located on opposite end of head-house.

Figure 2 is a plan of the upper surface of platform; *a*, a track on which car is run from cage to tippie; *b*, a guard-timber bolted at centre to tippie platform, and further secured in position by turning the ends of rails in a vertical position after passing under guard-piece *b*, as shown at *a*, Fig. 3. Iron plates ½x3x11 inches are indicated by heavy lines at *b*, Fig. 2, and bolted to guard-timber to protect it from wear of the car-wheels. When not in use the tippie is held secure in position by the flat iron bolt *c*, which is ½x3½x16 inches, and is held in position by two iron straps bolted to platform, shown in section at *d*. At *e* an iron plate is represented also bolted to platform, to which a chain is attached about four and a half feet long, having a hook on opposite end, which can be inserted into an eye fixed in frame-work of rear end of car when tippie is used, to prevent car from turning over.

The frame of this platform is made of twelve-inch timbers, supported at head-house by a plate 6x12 inches, bolted to the frame of latter, and on opposite end by a plate of similar dimensions, resting on two posts twelve inches square, but one of the latter is set at an angle of about thirty degrees from the vertical to give more room for box of dump-car. The length of platform is 15 feet 9 inches long, and width 8 feet 5 inches. The space five feet in length between head-house and tippie is covered with oak plank three inches thick. The portion of platform at side of tippie which is required to sustain only the weight of the men operating it can be covered with one-inch pine boards.

Figure 3 represents a longitudinal section of tippie which is four feet four inches square, composed of oak plank two inches thick, spiked to cross-pieces at each end, which are also of oak, one inch thick and eight or more inches wide. This platform revolves on a horizontal bar shown in plan by Fig. 4, and in section at *f* in Figs. 3 and 5. In Fig. 3 *g* represents a section of strap-iron two inches wide and half an inch thick, applied to secure *f*, which forms the axis, firmly in position. This is done by means of three-quarter inch bolts that pass through iron

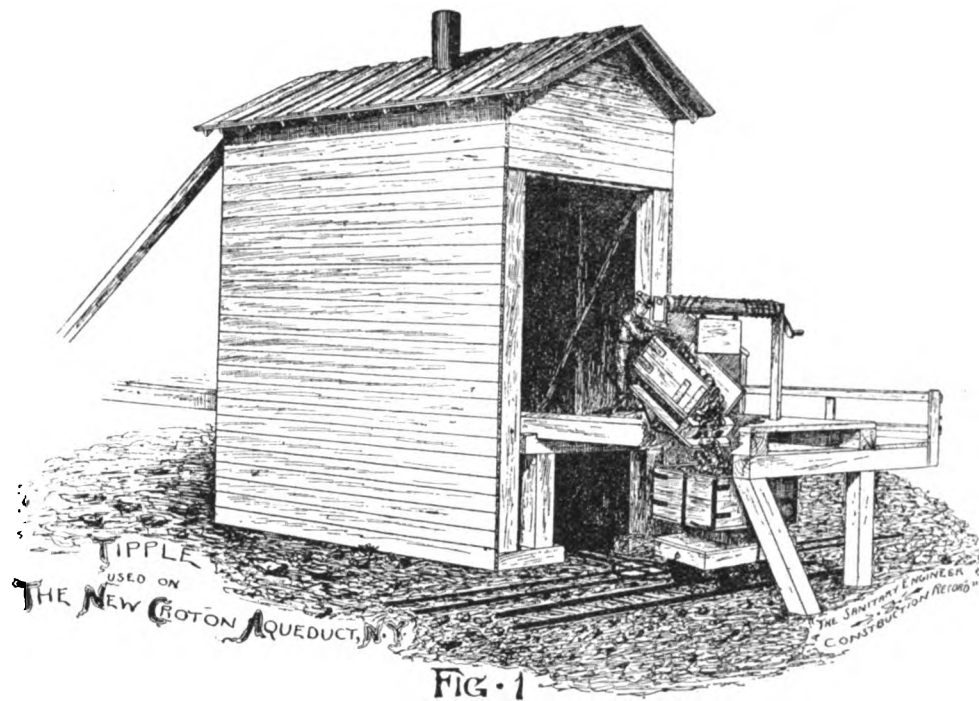


FIG. 1

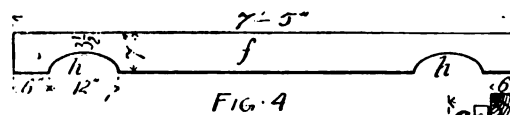


FIG. 4

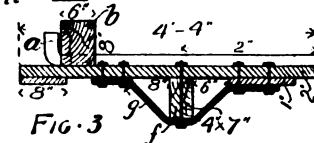


FIG. 3

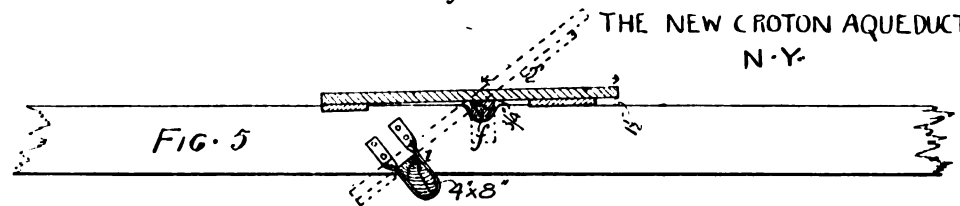
DETAILS OF TIPPLE
USED ONTHE NEW CROTON AQUEDUCT
N. Y.

FIG. 5

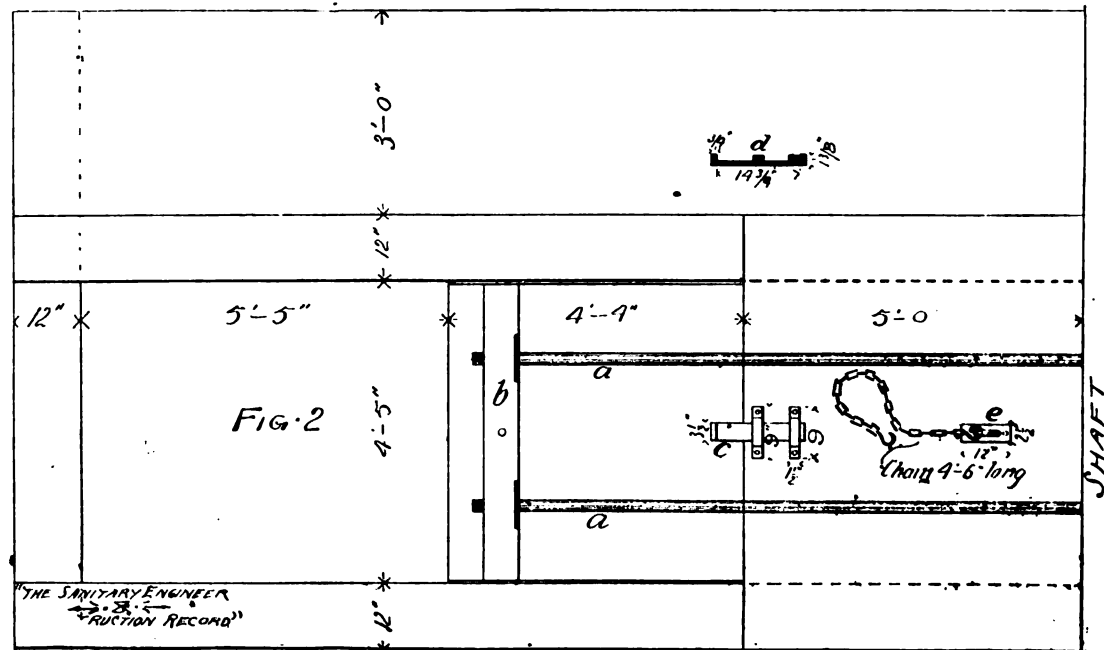


FIG. 2

strap *g*, oak piece *f*, and also platform of tippie, being still further secured by two one-half inch bolts, inserted at each end of strap-iron. The drawings represent only one iron strap, but in construction there are two.

Figure 4 is a longitudinal section of *f*, the axis of tippie, which is made of oak 4x7 inches, and cut out at *h h*, making it circular, which form the trunnions on which the tippie revolves, that are supported by two 12-inch timbers composing part of the frame of platform; the latter also are cut out on upper surface at *f*, Fig. 5, to fit the trunnions *h h*. A wrought-iron pipe 3½ inches in diameter may be utilized for a horizontal bar, and would be preferable to one of wood.

Figure 5 represents inner side of 12-inch timber, comprising part of platform frame, with relative position of tippie and guard. The tippie platform is canted about 1½ inches at rear end to modify centre of gravity in dumping the car and allow more freedom of action in the tippie. To prevent the tippie turning too far and dump the car, a

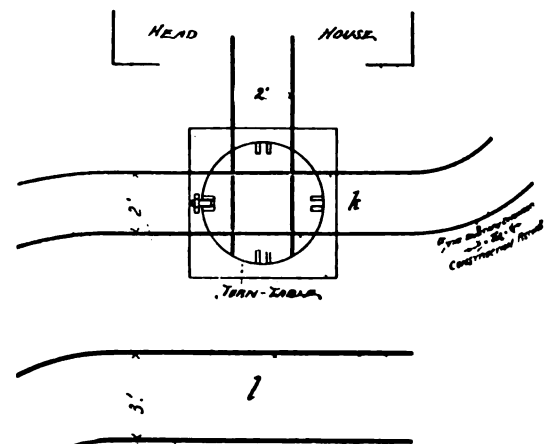


FIG. 6

THE NEW CROTON AQUEDUCT, N. Y.

guard is placed in position as shown at *i*, made of pine 4x8 inches and fitted between the platform frame, secured by iron hangers that are ½-inch thick and 1½ inches wide, bolted to the timbers on which trunnions rest. The broad side of the hangers are fitted to the timbers by twisting, as shown at *i*, and then secured by ½-inch bolts passing through both hangers and timber.

Figure 6 shows relative position of head-house and tracks at ground-level, the track *l* being utilized for the "dump-car" only in removal of material to spoil-bank. The inner track *k* is intended for the small or tunnel cars when building material such as brick, cement, etc., are required for construction in tunnel. The tracks for tunnel cars at shaft 22 extend to the head-house from the platform on which sand and cement is mixed dry (no water being added until delivered on the work in tunnel); and on opposite side from brickyard. The change in direction of car is made by a small turntable, placed opposite entrance, shown in Fig. 6, on which it can be easily turned and run on the cage in the head-house, and thence taken to any point in the tunnel where required.

The cars used on upper division are larger than tunnel-car described, only one size being used for delivery of building material, and removing stone and debris to spoil-bank, the entrance to head-house being only at ground-level. It is claimed for the plan of using both small and large cars that less number of trips are required to spoil-bank, thereby saving time of men, and the small tunnel-cars interfering less with workmen in the tunnel.

The tippie was designed by E. J. Farrell, of the firm of Rodgers & Farrell, Superintendents of Section 11, for Messrs. O'Brien & Clark, the contractors for sections 6 to 12, inclusive, of the new Croton Aqueduct.

PAVEMENTS AND STREET RAILROADS.

No. X.

(Continued from page 266.)

ASPHALT AND CONCRETE FOOT-PAVEMENTS.*

IN Archway Road, Hornsey, another experiment was made by covering the screed mark with a strip of mastic asphalt nine inches in width and ½-inch thick, just as in the last case with felt. For three months no cracks appeared; then a few slowly and at irregular intervals showed themselves; but during the severe winter of 1886-7 every screed mark showed its crack. These cracks were irregular in line, but they are confined in each case to the area covered by the mastic asphalt. These footways are laid on a 3-inch foundation of concrete. In Marlborough Road, Chelsea, an experiment was made on different lines. A foundation of concrete six inches thick was laid, and the compressed asphalt laid on it. For four months no cracks appeared, but after that time they occurred at frequent intervals, though they are fewer than usually appear on a 3-inch foundation. When the asphalt and concrete were removed at the cracks it was found that the crack extended through the whole thickness of the concrete. This experiment was based on the observation that cracks do not appear in compressed asphalt carriageways, and as the principal difference between the foundations in the footways and carriageways is the thickness of the concrete, it was assumed that it was the cause. The observation is, however, an incomplete one. In streets of light traffic the cracks do appear in the asphalt, as in Little Blenheim Street, Chelsea, and elsewhere. In streets of heavy traffic the cracks in the concrete tear the asphalt as they slowly form, but the traffic welds the asphalt together again before they show on the surface. In footways of heavy traffic there are fewer cracks than in those of light traffic, for a similar reason. At Muswell Hill, Hornsey, the experiment of covering the whole of the area of the footway between Onslow Rise and Grosvenor Gardens with bituminous felt was tried. The felt was in 3-foot widths, and was laid longitudinally with butt joints. At the circular kerb the pieces were necessarily somewhat patched. The result has been that cracks have appeared at every joint of the felt with marvelous fidelity, owing to the movement of the concrete. In Whitehead's Grove, Chelsea, between Marlborough Road and Keppel Street, on the north side, a length was laid in 1885 on a 3-inch concrete foundation, which was covered with mastic asphalt ½-inch in thickness. On this ½-inch of compressed asphalt is laid. The mastic asphalt was laid to absorb by its elasticity the movement of the concrete without transmitting it to the compressed asphalt. It has survived two winters of great severity, and has lived twenty-one months without any cracks appearing. From this it would appear that the principle of a material between the concrete and the compressed asphalt which will absorb the effects of the movements of the concrete is a correct one, and the writer invites the members of the association to experiment on cheapening the method. The present result is an increase of life of 33 per cent. at an increase of cost of 12 per cent.

As evidence of the durability of compressed asphalt in footways, those in Cheapside may be mentioned. They

were laid in 1876 at a thickness of 1 inch, and are now wearing through. On the south side of the Strand east of Wellington Street 1 inch of compressed asphalt was laid in 1881, and has had only the most trifling repairs. The streets in the city with the heaviest foot traffics in the world are paved with compressed asphalt on the footways.

The advantages of asphalt foot pavements are durability, a smooth surface unbroken with joints, a good foothold, even and regular wear, their impervious character, and the readiness and neatness with which they are repaired. They have a sombre appearance, and show water on their surface longer than stone pavements. They wear to the last thickness without breaking up, and give a useful wear for the whole of their thickness. When a stone or other pavement has worn 1 inch it may not be half worn through, but its usual life is over. Where there are cellars under footways, asphalt as a material for footways is unrivaled. In ordinary traffics, such as those named in King's Road (7,000 to 8,000 persons per day), an asphalt pavement can be laid 1 inch thick with the certainty that for at least ten years it will need no repairs whatever. This pavement has also the advantage that the foundation is always preserved and good for use again when the wearing surface of asphalt has to be renewed.

The following abstract of the present contract schedule in Chelsea will give the prices for these pavements:

	Persq. yd.
£ s. d.	
Compressed or mastic asphalt 1 inch in thickness on 3 inches of concrete.....	0 6 3
Ditto, ditto, ¾ inch thick.....	0 5 6
Compressed asphalt ¾ inch thick on ¾ inch of mastic asphalt, laid on 3 inches of concrete.....	0 7 0
Compressed or mastic asphalt 1 inch thick on existing concrete foundation (relay).....	0 3 6
Ditto, ditto, ¾ inch thick.....	0 3 0

These prices carry a guarantee of free maintenance for ten years. The vestry prepares the foundation for the concrete in new work at a cost of 2d. per square yard. The specification provides that the asphalt will be cut open at distances not exceeding 50 feet apart, and the thickness measured. Five out of every six of these measurements must be at least the specified thickness, and the average of every six must be at least the specified thickness. The specification is strictly adhered to. The cost of the foot pavement in New Bond Street, already referred to, over twenty-six years would be as follows at per square yard:

	£ s. d.
Preparing foundation.....	0 0 2
Laying concrete foundation and ¾ inch mastic asphalt.....	0 5 6
At end of 13 years relaying mastic asphalt (life 13 years).....	0 3 0
Repairs.....	0 0 0
Total.....	0 8 8

or a cost per year, not including interest, of 4d. per square yard. It should be mentioned that the small cost of renewing asphalt footways is due to the fact that the asphalt taken up is as good as new asphalt after it has been cleared and prepared, and is re-used for footways.

In dealing with the question of concrete as a material for foot pavements, the writer cannot claim such an experience of it as he has had with asphalt. In 1880, however, the Vestry of Chelsea had laid by the respective makers a series of pavements in King's Road against the Royal Military Asylum wall, and in 1885 a report was made on them by the writer. So many applications for copies have been made that it is now out of print, and as applications continue to be made, the results of the experiments are herein set forth for the information of the Association.

The writer holds that a knowledge of the manufacture of these pavements is useful information, and therefore he incorporates a description of the manufacture of imperial stone pavements. The depot of the company is at East Greenwich, on the banks of the Thames. The aggregate used by the company is broken granite. Flint has been used, but the pavement in wear became very slippery. Kentish rag has also been used, but its wear was too rapid. The granite is broken, so that it passes a 1½ sieve. After screening it is carefully washed, as the dust acts as a coat round the piece, and prevents the cement laying hold of the granite. The washing machine is a slanting archimedean screw, working in a trough, with openings in the thread of the worm. The water is run in at the high end, and the screened granite pieces put in at the lower. The screw churns the pieces over and over each other, and carries them up by its motion. The clean water meets the cleanest granite, and thus the pieces are not soiled by the dirty water they make. About 8 per cent. by weight is washed out as waste. The importance of a clean aggregate is seen when it is stated that briquettes made from washed pieces have a tensile strain of 15 to 20 per cent. higher than those made from unwashed pieces, when tested under similar conditions. The cement used is the best Portland, and is required to stand a tensile strain of 350 lbs. per square inch after seven days' immersion in water. As a matter of fact, the cement used runs to an average of 425 lbs. on the square inch. Hitherto a residue not exceeding 10 per cent. on a 50-mesh was allowed, but the value of increased fineness is recognized, and preparations are being made for a cement that will not leave a residue of 10 per cent. on a 76-mesh. The weight runs from 116 to 120 lbs. per struck bushel. Before use, the cement is laid out to cool for fourteen days, and is turned

frequently in that time. Great care is taken to keep the direct rays of the sun off the cement. The company exposed part of a sample of cement to the sun, and exposed the other part to the air. It was found that the part exposed to the sun showed loss of strength equal to 50 per cent.

The soluble silica used for the induration of the stone is a clear viscous substance made from pure flint and caustic soda, which are digested by heat under pressure in Papin's digester or an analogous machine. Its strength is technically known as 140° Twaddle, which shows 1,700 on a hydrometer. The silica is diluted with water until it shows 1,250 or 1,300 on the hydrometer, and is then a clear copper-colored liquid.

The stone is made of three parts by measure of washed granite and one part of cement. They are thoroughly incorporated in a dry state in a horizontal cylinder by machinery, and when this is secured, water is sparingly added, and the mixing continued. At each mixing there is made sufficient concrete for a 3'x2'x2' slab only. When it is ready for putting in the mold, the concrete does not appear to the eye to be sufficiently wet. The molds are metal-lined, true in shape, with clearly defined arrises. Before the concrete is placed into them they are oiled all over, and then placed on a trembler. This is a machine which gives a rapid vertical jolting motion to the mold. When the machine is started, the concrete is placed into the mold by small shovelfuls at a time, and two men with trowels spread it over the mold. When the mold is filled they pat the concrete with the trowels, the water rises to the surface and an even smooth face is secured. The mold and concrete are then removed to a rest for two days. The whole operation of mixing the concrete and making the slab in the mold is completed in six minutes. Machine-made stones are of necessity homogeneous, as veneering is impossible during the process. The slabs when taken from the molds at the end of the two days are air-dried for seven or nine days, and then immersed in a silica bath for seven or nine days more. They are then stacked in the open for some months before use. The value of the silica bath is in hastening the hardening of the stone. At the end of a month the stone will stand from 30 to 40 per cent. more tensile strain if silicated than if air-dried only. It is doubted by Mr. Faija whether silicating increases the ultimate strength of concretes.

The stone so prepared stands a tensile strain of 650 lbs. on the square inch when three months old. Strains of 1,000 lbs. have been obtained, but they are not the average. The value and excellence of this concrete is shown by the fact that though the neat cement has 75 per cent. of aggregate added to it, yet in three months the mixture bears nearly double the tensile strain of the neat cement after seven days. The writer was shown the original of a report by Kirkaldy, dated 6th September, 1882, in which one sample of stone took 8,075 lbs. per square inch to crush it, and another reached the marvelous strength of requiring 9,492 lbs. per square inch to crush it.

In the King's Road experimental pavements the makers laid their pavements with the knowledge that they were competing with their rivals. They were laid in 1880. Asphalt, York stone, Ferrumite stone, Victoria stone, and Imperial stone were laid side by side and subjected to the same traffics. The writer includes the York stone results, though not strictly coming within the subject of the paper.

In June, 1884, the Ferrumite stone was removed, as its slipperiness had become a source of danger. Its area was taken by Wilkinson's granite concrete pavement and by Shap-stone pavement. After five years' wear of the original stones, the following results were obtained:

The York stone occupied an area of 87 square yards; the original thickness was 3 inches; the number of stones 123, of which, after five years' wear, 10 had broken edges, 16 had broken corners, 21 had their surfaces peeling off, and 6 were worn so as to be dangerous. The wear was not measurable by reason of the uneven thickness of the stones, but it was unmistakable. The foothold was good in all weathers. The actual cost was 8s. 7d. per square yard laid.

The Victoria stone occupied an area of 81½ sq. yds.; the original thickness was 2 inches; the number of stones 168, of which 35 had broken edges and corners, two had their surfaces peeling off, and 3 were visibly cracked across. The wear was not quite ¼ inch at the greatest traffic line. The joints of the stone were pleasing, and the color cheerful. The foothold is not so sure as that of York stone in dry weather, and in a drizzling rain it approaches slipperiness. The cost was 6s. 4d. per square yard laid.

The Imperial stone occupied an area of 90¼ square yards; the original thickness was a full 2½ inches; the number of stones 187, of which 18 had their corners and edges broken, and one had its surface partly peeled off. The wear was not quite ¼ inch at the greatest traffic line. The regularity of the joints is pleasing to the eye, and the color is light and cheerful. The foothold is more sure than that of the Victoria stone sample, but it becomes somewhat slippery in drizzling rain. The cost was 6s. per square yard laid.

The experience gained with the Shap-stone laid in 1884 is more limited, but the stone does not appear to be better than the concrete stones described. The length laid *in situ* by Messrs. Wilkinson is subject to the same remark, but the aggregate is already wearing up. It is laid in 8-feet bays. A repair made in it is a great dissight to it. The effect of the traffic in wear is visible.

Mr. Walker, of Leeds, has laid down (1886) in King's Road a short length, in bays about 4 feet square. It has

* A paper by George R. Strachan, A. M., Inst. C. E., of Chelsea, London, S. W., read at the annual meeting of the Association of Municipal and Sanitary Engineers at Leicester, July, 1887.

a very smooth surface, and appears to be a very good pavement. He lays a foundation of ballast concrete $2\frac{1}{2}$ inches thick to within $\frac{1}{2}$ inch of the finished surface, and cuts roughly through it so as to form the bays. He then floats the surface with fine rich concrete, made of one part of cement to one or one and a quarter parts of crushed granite or slag which pass through a $\frac{1}{8}$ sieve. This is then cut through with a knife into bays of small areas. The foothold is fairly secure and the wear very satisfactory. No cracks appear when the bays are made less than 10 feet square. At 322 Oxford Street a piece has been down three years, and no wear is visible. He claims that his fine rich concrete on the surface attains more nearly to the texture of York stone than any other pavement. The joints, however, have a tendency to spread.

Concrete pavements laid in slabs have two serious disadvantages. The writer's experience refers to Victoria stone, but there is no reason to suppose that slabs of other make are free from them. The first is the annoyance caused by the hard metallic sound of the footfall on them, which is especially noticeable at night. The other is their brittle nature and the presence of hidden cracks after wear. When taken up to relay, it is often found that a stone which was apparently sound, breaks before it can be relaid.

Concrete pavements *in situ* have the serious disadvantage that they cannot readily and cheaply be repaired. A patch in them shows for the whole life of the pavement, unless a whole bay is removed.

The writer is of opinion that concrete pavements *in situ* are preferable to concrete pavements laid as slabs. There is, however, no reason why this pavement should not be laid by surveyors themselves, without the aid of a contractor. Much has to be learned before concrete as a material for foot-pavements is perfected, but that can most readily be learned by each engineer doing his own work, and exchanging experiences. The prices paid for concrete pavements are very great. One stone is advertised for 7d. per square foot, which equals £4 14s. 6d. a cubic yard. This is an extravagant price to pay for concrete, even if it be of the very best kind, and silicated, too. Concrete for foot-pavements has its own field, and within well-marked limits its use is advisable, but until its capabilities are more largely tried and its usefulness increased, the full advantage will not be obtained from it. The price stated is large enough to cover the cost of experimenting, and the writer trusts that the members will carry out such a series of tests and trials as will complete the knowledge of concrete as a material for foot-pavements.

THE DRIVEN WELL SYSTEM AS A SOURCE OF OR A MEANS OF OBTAINING A WATER-SUPPLY.*

(Continued from page 265.)

In order to determine the advisability of a district to furnish a supply of ground-water, the topography and geological formation must be carefully studied. If taken from porous strata, underlying impervious strata, then its outcrop must be carefully traced to determine the area to be depended upon, its elevation above the points from which it is to be taken, and the amount of water and the rapidity with which it will yield its stored waters. If it is to be depended upon as the only source of supply, then the storage capacity from the plane of the frictional grade of the ground-water and above the level from which it is to be taken must be equal to the maximum consumption during the months of the year when the percolation is less than the demand.

We have numerous instances of large amounts of water being thus obtained, and, as in many portions of our country the stratification is homogeneous in character with an outcrop covering large areas, the amount of water to be obtained can be closely estimated. The causes of failure are numerous and the work should only be undertaken after a careful testing of the capacity of the soil. Experimental wells should be driven and the effect continued pumping may have on the ground-water carefully noted.

If, by pumping, the level of the water is quickly drawn down and continues with a uniform yield and a quick recovery of the original level upon stopping the pumps, then it may be assumed that the storage area is small, but the supply is constant through an open strata.

If the yield should be equal to the capacity of the pipes without lowering the ground-water, then may the supply be assumed to be abundant. If the level is reduced slowly and has an equally slow recovery, it would indicate thereby a storage-reservoir without a material supply. It is found in about all drift formations that a layer of gravel or coarse sand, variable in thickness, lies just above the bed-rock. In this layer the freest flow of water can ordinarily be found.

The ground-water, when first drawn to the surface, is usually of a temperature of from 48° Fah. to 51° Fah., the

temperature of the ground, which approximates the mean temperature of the atmosphere for the year. If reinforced by surface-water, then the temperature is raised or lowered to the season of the year and the distance it has had to pass through the soil.

As compared with surface-water, it is less liable to contamination from organic substances and can be delivered at a lower temperature in summer and a higher temperature in winter.

The tube, or driven well, as compared with an open well, is usually driven to a greater depth and into various strata, and thus the water, from its slow filtration through the soil and partial oxidation, is less liable to pollution. If these strata should be more open than those in which the open well is placed, then would the friction be less, the circle of influence be enlarged, and the yield so much greater.

A series of driven wells located at such a distance apart as to draft upon the area within their limits, extends the circle of influence as far beyond that of the open well as the distance between the extreme wells is greater than the diameter of the open well; this is modified by the variable-ness of the strata from which each is drafting.

The driven well also has the advantage of being practicable in soil through which it would be impossible or difficult to construct an open well.

Probably the most successful plants of small tubular wells are those put in by William D. Andrews & Bros. for the city of Brooklyn, L. I., N. Y. The surface of the ground of the western portion of Long Island rises gradually from the ocean on the south to the ridge on the north. The slope has long flat lateral slopes crossing the general slope which serve as collectors of the excess of water over and above what the ground will absorb, which appears in the form of small streams and numerous ponds and swamps which serve to store the surface-water. The subsoil is for the most part sand and gravel of a homogeneous character.

The source of the Brooklyn water-supply is in streams, ponds, and open and driven wells. The grade of the ground-water is from seven to twelve feet per mile.

The average daily consumption for the year 1886 was about forty-five millions of gallons, with a maximum consumption of fifty-eight millions of gallons. Of this, twenty millions of gallons per day was supplied during the time of severest drouth from the driven-well systems. These wells are located parallel to the line of the conduit and across these small lateral valleys before mentioned. Spring Creek and Baisley Station, so-called, were constructed in 1882, and yielded over nine millions of gallons daily for several months in 1885.

The plant consists at each of these stations of 100 2-inch pipes driven with a patent well point.

The depth of the wells varies from forty to seventy feet. The elevation of the ground is about ten feet above tide-water. Experiments with test wells at Spring Creek did not show any effect upon the ground-water 2,000 feet away, but I am not informed as to how long the test was continued or to what level the water was drawn at the wells.

In 1884 Forest Stream and Clear Stream Stations were built. These stations averaged for eight months, in 1885, during the drought, over 10,500,000 gallons daily. There are 240 2-inch wells at these two stations. The depths and elevations of these wells are about the same as at the first stations.

I am informed that over 12,000,000 gallons per day have been pumped from these two stations, and constant pumping does not appear to have reduced the supply. Three open wells, fifty feet in diameter, which are placed in similar, or more favorable conditions to those of the driven wells, and sunk so as to have fifteen feet of water, will not yield over 1,000,000 gallons per day.

In 1875, at Long Island City, in the construction of a brick well, fifty feet in diameter, a large flow of quicksand was encountered which threatened its destruction, but a 6-inch pipe, driven in the bottom about thirty feet deep, concentrated the flow of water and no change has since occurred. The well supplied 500,000 gallons per day. Three 4-inch pipes were driven to about the same depth as the open-well pipe, and in opposite directions from it, at a maximum distance of 5,605 feet from the wells. These showed a yield of 40,000 gallons each per day in addition to that obtained from the well. These pipes were attached to the suction-pipe from the well. The claim for this arrangement was that the water in the well being drawn to a lower level than the ground-water acted as a syphon pipe, thus equalizing the draft.

I am informed by the engineer that the yield has increased rather than diminished. These pipes were driven with open ends and perforated with $\frac{1}{4}$ -inch holes for a distance of two feet from the end.

At East New York, a well fifteen inches in diameter and fifteen feet in depth of water yields between 200,000 and 300,000 gallons per day of twelve hours' working.

A 6-inch pipe was driven in the centre and three outside, at even distance from the well, about fifty feet, and attached to the suction as at Long Island City. The yield was brought up to one million gallons per day of twelve hours.

At Dayton, O., a series of nine 6-inch wells, driven forty to forty-five feet in the former bed of the Mad River, and cleared by the Wagner Steamed Well Process, gave a daily yield, in January, 1886, of 3,260,000 gallons.

At Franklin, O., six wells six inches in diameter, driven sixty to seventy feet deep, through twenty-six feet of gravel, one foot of soil, ten feet of clay and gravel, and twelve feet more or less of gravel, it is claimed yielded over 1,000,000 gallons per day.

At Texarkana, Ark., a set of ten wells was sunk about forty-five feet deep, through twelve feet of quicksand, thirteen feet of gravel, three feet of yellow sand and hard, tough clay, and eighteen feet of coarse gravel resting on a bed of fine sand. A test of twelve days' continuous run, yielding from 625 to 825 gallons per minute, lowered the ground water five feet, the water returning to its normal height in about four hours after the completion of the test.

At Terre Haute, Ind., a set of ten 8-inch wells, sunk about twenty-three feet, yielded 2,700 gallons per minute.

In our immediate neighborhood we have a number of plants which have been to a considerable degree successful, certainly more so than open wells or conduits could be expected to have been under the conditions.

At Hyde Park, Mass., in the valley of the Neponset River, at the foot of the Blue Hills, is located a plant of sixty-four 2-inch wells, placed so as to intercept the ground flow of the valley, and connected by 8-inch and 10-inch suction pipes to the pumps.

The pipes were perforated eighteen inches to two feet on the side and driven with open ends from twenty-two to forty-five feet deep.

The temperature of the water was uniformly 50° Fah., and 900 gallons per minute were discharged.

During a test continuing five days of ten hours' pumping, the vacuum gauge at the start showed ten inches vacuum, and at the close $15\frac{1}{2}$ inches, and a maximum variation of $2\frac{1}{2}$ inches per day was also shown. I am informed that the extreme variation in level of the ground-water 1,500 feet away was two inches.

At Cohasset, Mass., a set of sixty-five 2-inch wells, driven from twenty-two to forty-five feet deep through clay, sand, and gravelly sand, and connected by a suction-pipe varying from four inches to ten inches in diameter to a pump, yielded, in a test lasting five days, 450,000 gallons per day. The ground-water was lowered ten feet at the wells and $1\frac{1}{2}$ inches 1,500 feet away.

At the State Homeopathic Insane Asylum, at Westboro, Mass., thirty-three 2-inch wells were sunk about fifty-five feet deep, through a clayey sand into from four to eight feet of gravel overlying bed-rock, and yielded, on a two days' test of ten hours each, 450 gallons per minute. The level of the water in a test tube 150 feet from the well was lowered seven feet in ten minutes and held at this level during the continuance of the pumping, rising to its normal level five minutes after the pumps were stopped.

At Newton, Mass., near the pumping-station of the Newton Water-Works, a set of eight wells (four 4 feet and four 6 feet in diameter) were driven to a depth of from thirty to forty-five feet through meadow mud, clayey quicksand, and into from two to six feet of coarse sand and gravel.

A test of continuous pumping, lasting thirty-one days, was made in August and September, 1886, and showed a daily yield of 324,000 gallons at the start and 283,000 on completion. The level of the water in the test tubes located from fifty to one hundred feet from the pipe-line was lowered twenty to twenty-two feet in two hours, and returned to its normal level in less than twenty-four hours after the stopping of the pumps.

THE Maine State Board of Health has commenced the issue of a monthly journal called the *Sanitary Inspector*, edited by the Secretary of the Board, Dr. A. G. Young. It is a very dangerous undertaking, but it is to be hoped that it will be so managed as not to injure the cause of public sanitation or the reputation of the board.

*A paper by Albert F. Noyes, City Engineer, Newton, Mass., published in the Journal of the New England Water-Works Association for June, 1887.

COKE AS BUILDING MATERIAL.

A GOOD suggestion has been made in the *Architect* by Mr. S. Smirke, R. A., as to the use of coke as a building material. He points out that volcanic scoria or pumice was used in the construction of the vaulting of the corridors of the amphitheatre at Catania. The springings and various main ribs were executed in very sound brick-work, whilst the interstices, spandrels, and other parts of the vaulting were wholly executed with this light yet hard material, in its rough state, but run in solidly with Pozzolana cement. This mode of construction has proved to be substantial by the permanence of the work in these ancient corridors. The dome of the Pantheon at Rome was executed in the same manner, and has stood the sieges, earthquakes, and all other causes of damage and decay, for nearly two thousand years. He adds: "Perhaps I may be permitted to say that I think it worthy of inquiry whether a safe, permanent, perhaps even economical vaulting might not be similarly executed with coke, a material which has many of the proper ties of this volcanic scoria or pumice." We can assure Mr. Smirke that many gas managers with a big coke heap would only be too delighted to dispose of it to the heroic builder who would practically demonstrate the efficiency of coke as a building material.—*English Exchange*.

THE USE OF CORRUGATED IRON FOR COFFER-DAMS.

In a paper before the Institute of Engineers on the Harbor Works in Algoa Bay, Cape Colony, Africa, the author, William Shield, Esq., mentions this novel use of corrugated iron, and it is of sufficient interest to warrant its reproduction as follows: "Corrugated sheet-iron, No. 24 B. W. G. in thickness, formed the dams for the piers and south abutment, being stayed inside with timber framing, and weighted with rails so that the dam sank into the sand and gravel as the excavation proceeded inside. The dams for the piers were about forty-two feet long, six feet wide, and eight feet high; and they were perfectly water-tight. The author thinks that this, as he believes, novel use of corrugated iron will be found satisfactory and economical where, as in the present instance, clay is expensive and difficult to obtain of good quality."

LESSONS FROM RAILWAY DISASTERS.

MR. CHARLES LATIMER, late President of the Civil Engineers' Club of Cleveland, at the annual banquet, in his annual address, said:

"Disasters are great teachers. Two fearful holocausts in this country, one at Rio on the Baltimore and Ohio, the other at White River in Vermont, and a wreck yet more terrible near Boston, teach us many things, among others: Let us not encourage our men to drink whiskey by keeping open saloons at the eating stations. 2d. Let us not use timber boxes for cars, that is sleeping and day coaches, varnished and painted to burn as quick as celluloid or gun-cotton. 3d. Do not use open fires. 4th. Do not use explosives for fuel or light on cars. 5th. Put safety-guards on re-railing trains at each side of every bridge. 6th. Do not overwork men. 7th. Rest men, beast, and material one day in seven. 8th. Be sober, be vigilant. Some recent disasters point plainly to the necessity of electric lighting, and heating, which must occupy the highest talent of the educated or natural engineer, and which presents a prolific field for the talent of the members of this club, especially those who represent those branches."

Referring to the Panama Canal he said:

"It has been the opinion of many engineers that the Panama Canal will never be finished, that the cost will run up to 400 or 600 millions of dollars. I am not of this opinion. I feel confident that it will be finished from ocean to ocean within a very few years. I believe that the Nicaragua Canal will also be finished and make the most beautiful and delightful transit imaginable through a country of unexampled loveliness, through a charming lake of pure water whose height above the ocean is the same as the height of Chautauqua is above Lake Erie—that is 742 feet—and the cost may not exceed \$100,000,000. I believe that the Eads ship-railway across the Isthmus of Tehuantepec is practicable and will also be built."

A NEW KIND OF SANITARY SWINDLE.

In an English police court, a few weeks ago, a person who is described as a civil engineer and a young man of respectable appearance, was committed for trial on the charge of obtaining money under false pretences. This he did by offering to appoint people as sole agents for their locality for a Sanitary Protection Association which did not exist. In one place he seems to have appointed eight "sole agents" for his bogus association. This form of swindle has not yet been tried in this country so far as we know, but it may be well to remember its possibility.

THE July number of the *Journal of the Franklin Institute* treats on a widely-distributed range of subjects. Opening with an interesting article on "Plant Analysis as an Applied Science," showing how much chemistry has done for the economical development of plant products, the next article treats of the "Henry Draper Memorial," established at Harvard in 1886 by Mrs. Draper for the purpose of continuing his investigations in dry-plate photography. Illustrations are given of the spectra of stars obtained by this process, with descriptions of methods, and an outline of work yet to be done.

The "Use of Oil for Stilling Waves" gives many instances of the efficiency of oil for this purpose, and arrives at the conclusion that it is undoubtedly beneficial. The author, Mr. T. F. Townsend, closes by presenting engravings of a metal lubricator ten inches in diameter, to take the place of the ordinary oil-bag, and furnish a uniform supply of oil under constant control.

The next article is a continued one by Professor William Cain on "Long Columns," treating the subject mathematically.

"Ransome's Improvement in the Manufacture of Portland Cement" is concluded. The chief interest in this article is the description of the use of furnace slags as a compound of cements. Physical tests of cement from slag as manufactured by Ransome gave the following results:

Age of cement.	Portland cement $2\frac{1}{4}$ " area of section. Weight of cement, 123 lbs. per bushel.	Ransome's slag cement $2\frac{1}{4}$ " area of section. Weight of cement, 120 lbs. per bush.
2 days.	Strength, 570 lbs.	Strength, 740 lbs.
3 "	" 698 "	" 870 "
7 "	" 818 "	" 1,170 "
28 "	" 1,325 "	" 1,440 "

The last article is a "Note on the Discharge of Turbine Water-Wheels," consisting of a discussion on the methods of computation, by J. P. Firzel.

The usual Scientific Notes and Comments close the number.

NEEDLE WITH ADJUSTABLE WEIGHT FOR TESTING LIME AND CEMENT.*

By means of a needle the setting of cements and hydraulic limes can be tested with varying weights.

The instrument consists of a tube terminating at its lower extremity with a flange or disk, which rests upon the surface of the cement test-piece. The tube is provided with a set screw at one side, and in it slides a rod into the lower end of which the steel needle is inserted. The length of the needle is 1.181 inch (0.03 metre), and its sectional area 0.0015 square inch (1 square millimetre), the upper end of the rod is provided with a small flange or platform, upon which the required number of zinc disks, each weighing 1.76 oz. (50 grams), can be placed. The rod itself weighs 50 grams. In one side of the rod, opposite the set screw, is a notch, the upper surface of which forms an inclined plane. Against this inclined plane the end of the screw rests, and by turning the screw the needle may be gradually lowered upon the surface of the test-piece. The upper part of the rod is furnished with a scale, upon which the depth to which the needle has penetrated may be read off.

Tables are given showing the difference in the progress of setting of various products.

WESTERN ASSOCIATION OF ARCHITECTS.

J. F. ALEXANDER, Secretary of the Western Association of Architects, Lafayette, Ind., has issued a circular calling the attention of the members of the association to a resolution adopted at the last convention, instructing the Board of Directors to drop from the rolls of the association all those whose practice is not in accordance with its by-laws. He has also issued a list of the members, with the request that such information be sent to the Board of Directors as will enable them to follow the association's order by excluding from the rolls any persons whose practice conflicts with the qualifications specified in the by-laws of the association. Announcement was also made that the names of applicants for membership should be sent to the Board of Directors on or before September 24, 1887.

* By H. Bonnami, taken from *La Nature*.
Proceedings of the Institution of Civil Engineers.

SANITARY WORK IN WISCONSIN.

THE State Board of Health of Wisconsin, in its annual report for 1886, declares its belief with regard to cholera that "wholly as a result of the effort made to prevent it from doing so, it has not yet appeared in any part of the United States." This is a doctrine to which we cannot subscribe, for we think that good luck has had more to do with the result than good conduct, but it must be admitted that the report of the Secretary of the Board, Dr. J. T. Reeve, is a very satisfactory one as indicating progress in sanitary education and work throughout the State. The law requires that every town, city, and village in the State shall organize a health board annually, which would require the organization of about 1,100 such boards in the State. Actually 930 such boards are reported, and many of these appear to have been busy in dealing with questions of nuisance, of the spread of contagious disease, of the proper relations between wells and privy-vaults, etc. Dr. Reeve states that "in very few instances has any special fund been appropriated for the use of the local Board of Health, but in very many the report is made that any expenditures authorized by that board have been promptly met from the general fund of the town."

The State as a whole was unusually healthy during the year. Small-pox appeared in a few localities, but was promptly and efficiently dealt with and readily stamped out. Typhoid fever was less prevalent than in former years, and the same may be said of all the forms of epidemic disease, except that diarrhoeal diseases have been frequent almost everywhere.

Following the Secretary's report are several papers of interest. The first is by Professor Erastus G. Smith, of Beloit College, on the results of investigation of some bright-colored candies. The most dangerous substance found was chrome yellow—i. e., chromate of lead. The second gives the result of an investigation of an epidemic of typhoid fever at Waterford, which appears to have been due to the contamination of a well. Other papers relate to sewerage, to school sanitation, to heredity, etc., the whole forming a volume of 250 pages which is highly creditable to the board.

MEDICAL CONGRESS.

THE programme for the International Medical Congress, which will meet in Washington next month, is about finished. It is now as follows:

Monday, September 5, General Meeting at Albaugh's Opera House, beginning at 11 A. M.—Organization of the Congress, report of Secretary-General, report of chairman of Local Committee. Address of welcome by Secretary of State Bayard. Address by the President of the Congress and other addresses. Afternoon session, beginning at 3 P. M. Evening conversazione, at Pension Hall, from 8 to 11 P. M.

Tuesday, September 6.—General address. First, Dr. Austin Flint, of New York, on "Fever, its Causes, Mechanism, and Rational Treatment;" second, Dr. Mariano Semmola, of Naples, Italy, on "Bacteriology and its Therapeutical Relations." Programme for all sections: Morning session, 11 A. M., adjourn at 1 P. M. Afternoon session, 3 to 6. Visit to Corcoran Art Gallery.

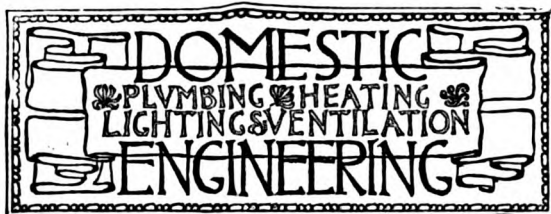
Wednesday, September 7.—General addresses. First, Dr. P. G. Unna, of Hamburg, Germany, on "The Relations of Dermatology to General Medicine;" second, Dr. G. Fielding Blanford, of London, on "The Treatment of Recent Cases of Insanity in Asylums and in Private Houses." Sections same as Tuesday, reception by citizens.

Thursday, September 8, General Meeting.—General addresses. First, Dr. A. Luteaud, of Paris, on the "Influence of Discoveries of American Surgeons on the Development of Gynecology in Europe;" second, Dr. Neudorfer, of Vienna, on the "Military Medicine of the Present and That of the Near Future." Section meeting as on Tuesday evening; general reception and buffet banquet at Pension Hall.

Friday, September 9, General Meeting at 10 A. M.—For general business. Sections. Morning session at 11 A. M., afternoon session at 3 P. M.

Saturday, General Meeting at 10 A. M.—Visit to Mt. Vernon.

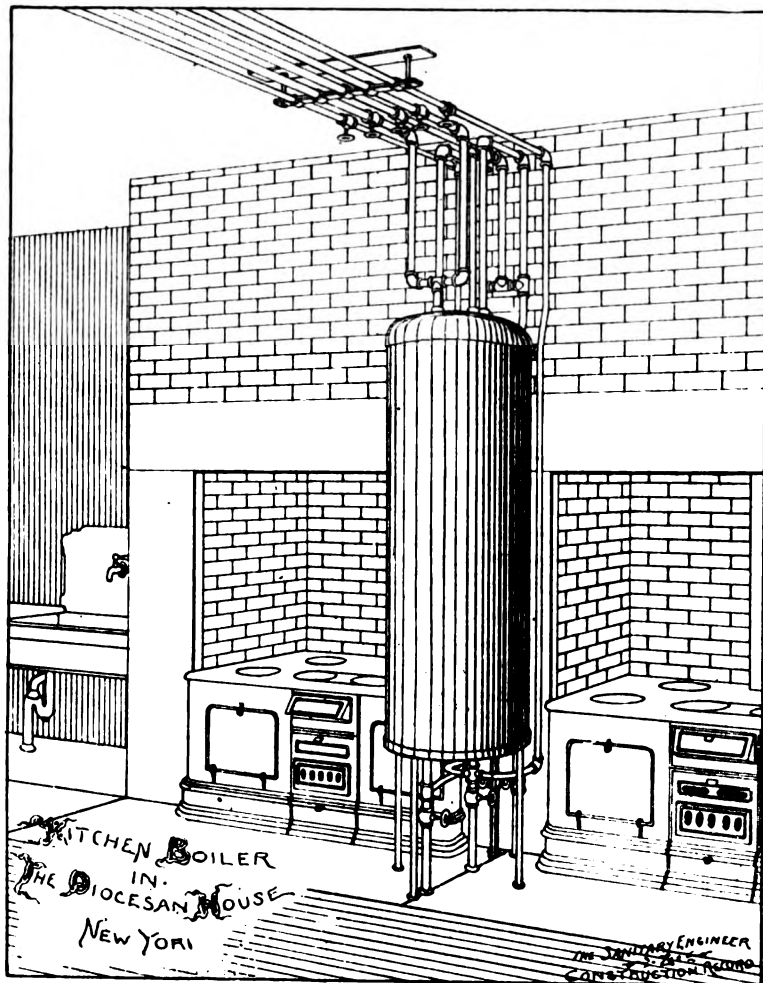
THE Philadelphia Board of Health has passed a resolution requesting architects to present separate plans of the drainage system of the buildings they may hereafter design.



KITCHEN BOILER IN THE NEW YORK DIOCESAN HOUSE.

WE illustrate this week the setting of the kitchen boiler in Bishop H. C. Potter's new "Diocesan House," 29 Lafayette Place, New York City.

The features of the work are its symmetry and compactness, together with the use of two circulation pipes, one for the supply to fixtures in the front of the building and the other for those at the rear. The skeleton diagram ex-



plains itself, with the exception of the "plug," which is made of a solid piece of metal, and inserted merely for symmetry. The sediment pipe discharges over a sink in the cellar.

The boiler is of heavy copper, with a capacity of 80 gallons, and the pipes galvanized iron.

The work was done by Mr. Charles Tucker, master plumber, 45 East Eleventh Street, from plans and specifications prepared by Frederick N. Owen, C. E., 13 William Street.

THE APPRENTICESHIP QUESTION.

THAT the apprenticeship question is one that the public appreciate as a live one is evidenced by the following editorial in a recent issue of the *New York Times*. Moreover, the consideration of such problems by plumbers' associations will do much to impress the public with the fact that there are thinking, public-spirited men in that craft deserving of something better than being the object of the newspaper funny man's too often labored efforts. The *Times* says:

"It is a promising sign that so much time was given at the National Convention of the Master Plumbers at Chicago and of the Master Painters in this city to considering the best methods of training apprentices. All over the United States the master mechanics are beginning to realize that it is their duty not only to keep up the standard of workmanship, but to see that the foreign workmen who do so much of the skilled work of this country do not exclude American young men from the trades by selfish union rules against their instruction. The patriarchal system of binding a lad to a master, who in return

for his services was not only to teach him a trade, but to receive him into his family, has long since disappeared.

"The master mechanic does not now work with his men, and cannot give much attention to his apprentices. There are also few respectable parents who would be willing to place their sons beyond their control, and there are few conscientious employers who would care to incur the responsibility implied in the old apprentice laws. The desire, however, on the part of the master mechanics to control in some way the labor of the lads they receive in their employ still remains, and this point was kept clearly in view in the discussions at the two conventions referred to. The difficulty of retaining a lad's services for a specified number of years lies in his unwillingness to work during the latter part of his term at low wages in consideration of past benefits, or even to admit that he has received anything more than he has already paid for by his labor. The attempt to force the young mechanic to work for less than he can get in the open market usually results in his abrupt departure, and perhaps, after repeated experience of this kind, in the master mechanic concluding that the young men of the present day are a shiftless lot.

London, Eng., designed to afford a method of drain testing which shall dispense with the necessity of a machine.



ACTUAL SIZE OF DRAIN GRENADE

This "Drain Grenade," or "Drain Ferret," consists of a cylindrical vessel, made either of gelatine or thin glass, about $2\frac{1}{2}$ inches long by $\frac{3}{8}$ of an inch diameter. It is charged with either peppermint, asafetida, or a special pungent compound. The "grenade" is thrown down the drain to be tested, due care being taken in the case of the glass one that it shall have sufficient fall to break, whereby the contents is, of course, released. In the case of the gelatine "grenade" the filling is, of course, released as soon as the gelatine is dissolved. A little hot water is thrown down the drain after the "grenade" in order to flush it through.

CUT-OFF VALVE FOR FLUID-SUPPLY PIPES.

THE accompanying illustrations, Figs. 1 and 2, show a new cut-off valve for pressure-supply pipes, lately invented and patented by Mr. Frank Moore, of Pittsburg, Pa.

The principal object of this class of valves is to automatically shut off the flow of natural-gas from a house or building should the pressure become so low in the mains as to allow the burner or lights to become extinguished.

Serious accidents and loss of life occurred in and around Pittsburg, when the natural-gas was first introduced, by interruptions to the pressure—caused by the shutting of the mains to make connections, etc. This caused the lights within the buildings to go out, and, in many instances, the gas was let on again with no one to attend to opened fixtures, the escape from which, being almost odorless, filled the rooms, causing poisoning or explosions. The present invention is to shut off the house service-pipe

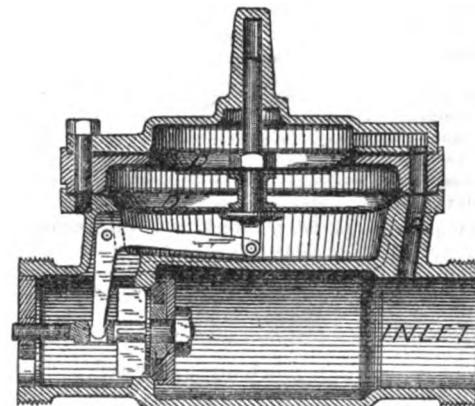


Fig. 2.

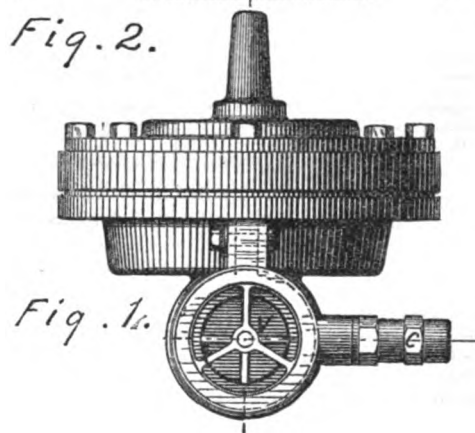


Fig. 1.

under such conditions, and keep it closed until opened with proper care, and after the burners within the house have been closed.

To accomplish this, the apparatus is introduced into the service-pipe, the street-pressure entering the inlet and forcing the valve V to its seat both by pressure on the back of the disk and by the pressure exerted by means of the upper diaphragm D, the street-pressure of the gas passing through the passage P to the top of the diaphragm and communicating its motion through the bell-crank and stem as shown. This is the position of the apparatus should the lights be put out in the house by an interruption of pressure or should a large pipe be broken, or should anything

that will reduce the pressure below some fixed

To open the valve so the regular flow of gas to the house, a small valve within the

"The fault, however, would seem to be not so much with the young men as with a system which seeks to lump the clever with the dull and the handy with the awkward, to require all to work for four or five years and then consider that they are skilled workmen. In such a system the more carefully a lad is trained in the workshop, or, as it is now proposed, in both the workshop and the trade-school, the greater the difficulty will be of retaining his services as he approaches manhood. If rules are devised to keep him, his young brain will devise some means to circumvent them. The interest the master mechanics are now taking in this apprentice question is a long step in the right direction. It concerns so deeply the welfare of many thousands of young men that it is important in any scheme to avoid as far as possible anything which may tend to discourage the masters or create a feeling of injustice among the apprentices. It might be possible to find some test of what constitutes a skilled workman besides the number of years passed in learning a trade. The main point would seem to be how much the apprentice knows when old enough to do a full day's work, not how long he was in acquiring his skill."

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

DRAIN TESTING.

THE illustration shows a new appliance, introduced by the Banner Sanitation Co., at Northumberland Ave

cap C is withdrawn by hand, allowing the high or street pressure to pass into the house-pipes by this by-pass, which is simply a direct communication between the inlet and outlet of the "cut-off" valve. This allows the pressure on the house side to increase until it acts on the under side of the diaphragm D', which is two or three times the area of D, pushing the latter up and holding the valve V open against the pressure and flow of the gas. As long as the pressure on the larger of the differential diaphragms is able to overcome the smaller one the valve will remain open. To natural-gas engineers the use of the apparatus is obvious.

WAGES IN GREAT BRITAIN.

THE *Engineer*, for May 27, in an article on "Wages in Great Britain," quotes the following as the ruling prices for some branches of trade in the localities named:

Wages Paid per Week of Fifty-four Hours in Derby—General Trades.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Bricklayers	32 5	34 4	37 1
Carpenters	32 5	36 6	39 5
Masons	39 5	40 7	41 9
Blacksmiths	31 4	34 4	36 6
Strikers	26 2	27 11	31 4
Horseshoers	29 11	31 9	33 9
Ironmolders	31 0	31 9	33 9
Burton	27 0	29 11	33 9
Chesterfield	23 7	27 4	31 4
Tinsmiths	23 7	27 4	31 4
Laborers	20 10	20 10	20 10

Wages Paid to Members of Trades' Unions.

Ironfounders, per week	<i>s. d.</i>
	32 0

Wages Paid per Week of Fifty-four Hours in Foundries, Iron-Works, and Machine Shops in Derby.

	<i>s. d.</i>
Drillers	26 0
Fitters	31 1
Holders-up	24 11
Molders	33 5
Pattern-makers	33 5
Planers	26 0
Riveters	30 1
Smiths	35 2
Strikers	26 4
Turners	27 0
Laborers	20 6

Rent averages 4s. 6d. per week, coal 12s. per ton, and gas 2s. 6d. per 1,000 cubic feet.

Wages paid per Week of Fifty-four Hours in Leicester—General Trades.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Bricklayers	30 7	31 4	34 11
Carpenters	30 7	34 4	37 1
Masons	36 1	38 3	39 2
Blacksmiths	29 6	32 4	34 4
Strikers	24 8	26 3	29 6
Horseshoers	27 0	31 9	32 11
Ironmolders	22 3	25 8	29 6
Tinsmiths	22 3	25 8	29 6
Laborers	19 8	19 8	19 8

Wages Paid Per Week of Fifty-four Hours in Foundries, Iron-Works and Machine Shops in Leicester.

	<i>s. d.</i>
Drillers	24 6
Fitters	29 4
Holders-up	23 6
Molders	31 9
Pattern-makers	31 6
Planers	24 6
Riveters	28 3
Smiths	33 2
Strikers	24 10
Turners	24 4
Laborers	19 6

Rent averages from 4s. to 4s. 6d. per week, coal is 14s. per ton, and gas 2s. 6d. per 1,000 cubic feet.

Average Wages Paid per Week in Plymouth—General Trades.

	<i>s. d.</i>
Bricklayers	25 0
Carpenters	29 2
Masons	20 10
Blacksmiths	20 10
Strikers	19 0
Brassfounders	20 10
Iron-molders	35 9
Millwrights	20 10
Tinsmiths	29 2
Laborers	18 9
Wages paid to members of trades unions:	
Carpenters, per hour	0 6½

Wages Paid per Day of Eight Hours in the Royal Dockyards.

	Established workmen.	Hired workmen.
	<i>s. d. s. d.</i>	<i>s. d. s. d.</i>
Bricklayers	4 6	4 0-4 6
Carpenters—		
Leading men	6 0-6 6	.. ..
Ordinary men	4 6	2 10-4 10
Single-stationed men	5 0-5 6	.. ..
Masons	4 6	3 0-3 4
Braziers	4 9	4 0-5 0
Calkers—		
Leading men	6 0-7 0	4 0-5 4
Ordinary men	5 0	.. ..
Coppersmiths—		
Leading men	8 0-9 0	6 8 0-10 0
Ordinary men	5 0-6 0	4 0-6 6
Engine-keepers	4 3	.. ..
Fitters—		
Leading men	8 0-9 0	8 0-10 0
Ordinary, ship branch	5 0-7 0	4 0-8 0
Ordinary, steam branch	5 0-7 0	.. ..
Founders—		
Leading men	8 0-9 0	8 0-10 0
Ordinary men	4 0-7 0	4 0-7 6
Locksmiths	4 9	4 0-4 6
Metal mills and sheathing shops—		
Leading men	7 3-7 9	.. ..
Workmen	3 3-6 3	.. ..
Oar machines—		
Oar finishers	4 0-5 0	.. ..
Machine laborers	5 6	.. ..
Saw sharpeners	4 0	.. ..
Pattern-makers—		
Leading men	8 0-9 0	8 0-10 0
Ordinary men	5 0-6 0	4 0-7 0
Sawmill	3 3-4 0	3 0-4 6
Sawyers—		
Pitmen	3 8	3 8
Topmen	4 2	4 2
Shipwrights—		
Leading men	6 0-7 0	.. ..
Ordinary men	5 0	4 0-5 4
Single-stationed	5 6-6 0	.. ..
Smiths—		
Ordinary	4 9-7 6	6 3 6-7 6
Hammermen	3 6-4 0	3 0-4 0
Wheelwrights	4 0-5 0	2 6-2 10
Apprentices	0 6-2 6	.. ..
Boys	1 0-2 6	.. ..

Established artificers in the Royal Dockyards have regular and uninterrupted work throughout the year, are employed eight hours a day, chiefly under cover, have holidays for which no deduction of pay is made, medical attendance, half pay when hurt at duty, superannuation after ten years' employment, promotion to the highest class of officers in their respective trades, and pensions are granted to widows of men killed in the service. Hired men do not enjoy promotion, superannuation, their widows are not entitled to pensions, and some of the men are liable to be discharged on the completion of certain work. The average rent paid by the better class of workmen in Plymouth is 2s. per week for one room, and 3s. 6d. per week for two rooms; laborers paying less, and getting worse accommodation. There are several blocks of artisans' dwellings at about the above rates, and also at 1s. 6d. and 2s. 6d. for one and two rooms, respectively, with very fair accommodation. Large numbers of dockyard workmen and skilled artisans have small houses of their own, which they pay for in the shape of purchase money and rent. Coal is 16s. and 17s. per ton, gas 1s. 11d. per 1,000 cubic feet.

Average Wages Paid per Week in Exeter—General Trades.

	<i>s. d.</i>
Bricklayers	25 0
Carpenters	29 2
Masons	21 0
Blacksmiths	21 0
Strikers	19 0
Brassfounders	21 0
Ironfounders	24 11
Mechanics—brass	29 6
" iron	30 0
" paper	27 6
Tinsmiths	29 0
Laborers—brass	15 0
" general	18 0
" iron	15 6
" paper	17 0

Wages Paid to Members of Trades Unions.

	Lowest.	Highest.
	<i>s. d.</i>	<i>s. d.</i>
Stonemasons—Shepton Mallet, (per hour)	0 5	0 6
Coach-makers—Taunton, (per week)	20 0	30 0

Rent paid by laborers in Exeter is from £6 to £8 per year; by mechanics, from £8 to £10 per year. The lowest rent of a single room, about 10 feet square by 7½ feet high, is 1s. 6d. per week. The Industrial Dwellings House Company have 82 tenements let at from 2s. 6d. to

4s. 6d. per week, and a few of a superior class let at 5s. 6d. per week. A great many more houses have been built than what have been pulled down, and there is every year an increasing number of small houses, ranging in value from £12 to £14. Coal is from 16s. to 18s. per ton, and gas 3s. 6d. per 1,000 cubic feet.

Wages Paid per Week of Fifty-six and one-half Hours in Southampton.

General Trades.	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Bricklayers	21 9	31 0	35 6
Carpenters	26 10	31 0	35 6
Masons	26 10	31 0	35 6
Blacksmiths	26 10	31 0	35 6
Strikers	24 8	26 10	31 4
Brassfounders	28 4	32 5	36 6
Coach builders	20 3	30 5	49 7
Cutlers	25 4	27 10	40 7
Horseshoers	20 0	25 4	30 5
Iron-molders	20 0	.. ..	37 10
Millwrights	25 4	27 10	30 5
Nail-makers (hand)	20 3	23 4	26 4
Tinsmiths	20 3	25 5	30 5
Laborers	18 3	20 3	22 3

Wages Paid per Week in Iron Ship-building Yards in Southampton.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Holders-up	27 3	33 3	39 6
Platers	35 6	45 0	54 9
Laborers	18 3	19 9	21 3

Rent is 5s. per week, coal is 19s. per ton, and gas from 3s. 2d. to 3s. 8d. per 1,000 cubic feet.

Wages Paid per Week of from Fifty-four to Fifty-nine Hours in Sunderland—General Trades.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Bricklayers	33 9	33 9	33 9
Carpenters	33 9	33 9	33 9
Masons	33 9	33 9	33 9
Blacksmiths	32 5	32 5	32 5
Strikers	18 3	18 3	18 3
Brassfounders	33 5	33 5	33 5
Horseshoers	30 5	31 3	34 5
Ironmolders	29 11	30 0	41 7
Tinsmiths	30 0	30 0	30 0
Laborers	10 2	10 2	18 3

Wages Paid to Members of Trades Unions.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Carpenters, house (per week)	35 0	35 0	35 0
Carpenters, ship (per week)	35 0	35 0	35 0
Amalgamated Engineers (per week)	35 0	35 0	35 0

Wages Paid Per Week of Fifty-four Hours in Brass and Iron-works Foundries and Machine Shops in Sunderland.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Boys, first class	8 0	8 0	15 0
Boys, second class	5 0	5 0	7 0
Finishers	35 6	35 6	35 6
Fitters	32 5	32 5	32 5
Foreman, foundry	45 4	50 8	60 8
Foreman, general	60 8	91 3	101 8
Ironmolders	35 3	35 3	35 3
Mechanics	34 6	34 6	36 6
Pattern makers	34 6	34 6	34 6
Laborers	22 3	22 3	25 8

Wages Paid per Week of Fifty-three Hours in Iron Ship-building Yards in Sunderland.

	Lowest.	Standard.	Highest.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Calkers	24 4	35 6	40 7
Cutlers	24 4	38 6	40 7
Drillers	24 4	38 4	40 5
Heaters—boys	26 4	11 3	26 4
Holders-up	26 4	31 6	42 6
Platers	32 4	32 4	32 4
Riveters	32 4	32 4	32 4
Smiths	33 0	33 0	33 0
Strikers	24 0	24 0	24 0
Laborers	18 3	21 3	30 5

Rent averages for three rooms from 4s. 8d. to 5s. 6d. per week. Coals from 12s. 6d. to 16s. per ton, and gas from 1s. 8d. to 2s. per 1,000 cubic feet.

COLONEL GEORGE E. WARING, JR., C. E., has just made a report on the sewerage of Kingston, Island of Jamaica. He estimates the cost of a separate system at a little more than \$100,000.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
August 6.....	23.66	21.15	20.87	30.05	27.43	22.09	29.65

E. G. LOVE, Ph.D., *Gas Examiner.*

NATIONAL ELECTRIC ASSOCIATION.

THE National Electric-Light Association met in Boston August 9. The opening address, by President J. F. Morrison, of Baltimore, rehearsed the improvements in incandescent lights, storage-batteries, and motors that had taken place since the last meeting, and advocated legislation to further promote the advantage of the uses of electricity. Mayor O'Brien delivered the address of welcome to the city. He hoped the association would show Boston how to better light her streets and dwellings. Mr. Arthur Stearns read the report of the Committee on Patent Legislation. It dwelt on unity of action in the Patent Office by the establishment of a commission or court within the department. The committee submitted a bill to be presented to the next Congress to carry the idea into practice. They have delegated the several members to use their influence with Congressmen, and recommend that the next meeting be held in Washington when Congress is in session. Mr. A. V. Garratt made the report of the Committee on Wire Gauge, giving the results of the formula of several mathematicians. The report of the Committee on Proper Insulation of Wires and Proper Installation and Construction of Plant was read. It expressed the opinion that a theoretical discussion of the subject would be of little value to those engaged in practical electrical work. They had therefore instituted practical tests by instruments of currents. They asked for means to pursue such tests, and suggested the issue of directions to companies which would secure the making of uniform tests on resistance, insulation, conduction, etc. The convention made an excursion to Lynn and other points.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

SIZE OF SAFETY-VALVES FOR STEAM-BOILERS.

NEW YORK, July 10, 1887.

SIR: (1) Will you kindly inform of a constant reader of your valuable journal the proper proportion of safety-valves to use on boilers and how to calculate them, say for a 100-horse-power boiler? (2) Whose safety-valves do you consider the best? Yours truly, B. W.

[(1) You do not state the class of safety-valve you desire to use nor the service they are for. Regulation 24 of the General Rules and Regulations of the Board of Supervising Inspectors of Steam Vessels (Section 4,418, Revised Statutes) says: "Lever safety-valves to be attached to marine boilers shall have an area of not less than one square to two square feet of the grate-surface of the boiler, and the seats of all such valves shall have an angle of inclination of forty-five degrees to the centre line of the axis. * * * Any spring-loaded safety-valve constructed so as to give an increased lift by the operation of steam, after being raised from its seat, or any spring-loaded safety-valve in any manner, or so as to give an effective area to that of the afore-mentioned spring-loaded safety-valve, may be used in lieu of the common lever-weighted valve in all boilers of steam vessels, and all such spring-loaded safety-valves shall be required to have an area of not less than one square inch to three square feet of grate-surface of the boiler. * * * But in no case shall any spring-loaded safety-valve be used * * * without first having been approved by the Board of Supervising Inspectors." These rules, you will see, are not directly proportional to the horse-power, but to the grate area.

We know of no true method of finding the area of a safety-valve by calculation. The common safety-valve, when set one square inch of area to two square feet of grate, will not relieve a boiler if the fires are in full force and all other means of drawing steam from the boiler closed.

Many of the pop safety-valves, so called, with differential seats and spring-loaded, on the other hand, are capable of relieving the boiler of all steam made, although they are only one square inch to three square feet of grate. This is because the escaping steam acts on a much greater area of disk after it begins to escape than it did before, forcing it further from its seat and getting greater passage for the escape of steam. These valves always open and close suddenly for this reason.

(2) We do not know who makes the best safety-valve, but the use of the following valves is allowed by the U. S. Board of Inspectors:

OPEN SAFETY-VALVES.

Common lever-valve.

Herreshoff Manufacturing Company, pop safety-valve.

LOCK-UP SAFETY-VALVES.

H. G. Ashton, East Cambridge, Mass.

Case & Baillie, Detroit, Mich.

J. D. Lynde, Philadelphia, Pa.

Richardson & Co., Troy, N. Y.

Dry-Dock Engine-Works, Detroit, Mich.

Cockburn's safety-valve.

Ashcroft's safety-valve.

Crosby's safety-valve.

McCrse's safety-valve.

Hodgin's safety-valve.

A. Orme's safety-valve.

W. E. Pierson, pop-valve.

George E. Collyer, safety-valve.

R. F. Silliman's safety-valve.

Consolidated Safety-Valve Company, Bridgeport, Conn., steam and vacuum gauge.]

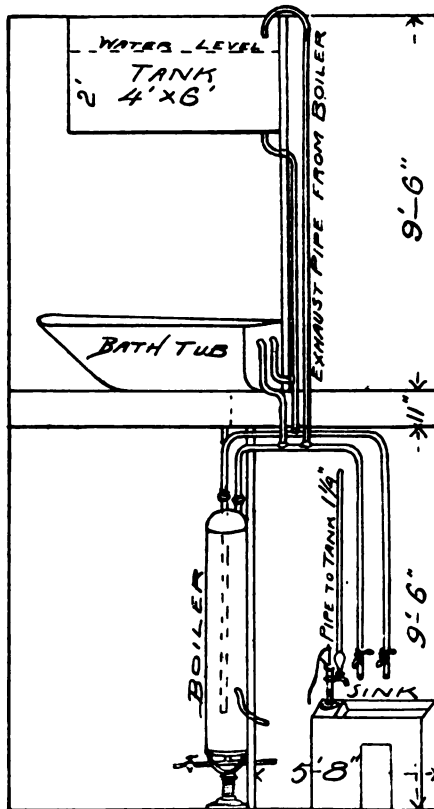
A KITCHEN-BOILER QUESTION.

GALT, ONT., July 20, 1887.

SIR: I inclose a drawing of a kitchen-boiler, and I want to know if the exhaust-pipe will keep the water in the tank from freezing if the fire is kept burning all night, which must be done anyway to prevent any danger of an explosion. I also wish to know if the pipes in drawing are put up right. The pipe is $\frac{3}{4}$ -inch all through, but supply-pipe from pumps, which is $1\frac{1}{4}$ -inch. I also want to know if I should do away with the exhaust-pipe in the kitchen-boiler drawing. Please give me a reply early as possible and oblige, yours truly, C. FITZGERALD.

P. S.—Is it proper to connect a bath-waste with a water-closet trap and not use a bath-trap, or to connect it beyond the seal and put a trap under bath—all traps ventilated?

[The pipe which you call an exhaust-pipe, which is in reality a vent and expansion-pipe from the hot-water system, will not keep the tank from freezing. The pipes in the drawing are well enough arranged, except, perhaps, it would be better to have the vent-pipe taken from the bath branch higher up instead of from the horizontal pipe. If it so happens there is a long distance between them, then leave it as it is.]



The bath should have a separate trap and the pipe from it should enter the soil-pipe and not the water-closet trap or pipe.]

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE association was called to order Wednesday morning in the library of Columbia College in New York by ex-President E. S. Morse, of Salem, Mass. Bishop Potter made a brief prayer and then retiring President Barnard, of Columbia College, made the address of welcome in a cordial and touching spirit. Professor Langley, President of the Association, replied, and then the work of the sections began.

Professor J. R. Easton was elected Vice-President of Section A (Astronomy and Mathematics). In Section B Vice President W. A. Anthony read an address on the "Importance to the Advancement of Physical Science of the Teaching of Physics in the Public Schools." Professor Anthony advocated the teaching of physical science in the schools as an important factor in directing the minds of men who would be engaged in various pursuits to the value of scientific truths, and securing their co-operation to a greater degree with the student of pure science. In Section H (Anthropology) Vice-President Brenton gave the address on a "Review of the Data for the Prehistoric Chronology of America." In Section F (Biology) Vice-President Farlow discussed "Vegetable Parasites and Evolution." He concluded that it was "highly probable that vegetable parasites originated at an early epoch from non-parasitic forms."

In section I (Economic Science and Statistics) Vice-President Alvord gave the sectional address on "Economy in the Management of the Soil." For food, clothing and shelter, he said, we are dependent directly or indirectly on the soil. The rapidly increasing demands of our own country are met and more than met, so far as mere quantity is concerned, for a great surplus is annually sent abroad. For twenty years agricultural products have constituted three-quarters of all the exports from the United States. And it is manifest that this superabundance of soil products will continue despite all possible increase in population at least well into the next century. But the wisdom and economy of our present systems of production and disposition is a very different matter. A steady draft continues upon the important elements of fertility, with no adequate system of rest, tuition or recuperation for the soil. Every crop removed from the land diminishes its store of plant-food and this reduces its productive power. The three most important elements of plant-food are nitrogen, potash and phosphoric acid. The effect upon the soil depends upon the disposition of the products embodying these. Fortunately very large parts remain upon or are returned to the land; on the other hand there are vast losses from waste besides the portions sent to foreign lands. With our rapidly increasing population and a constantly lessening fertility of soil, we have presented to us questions of the gravest importance. By the wasteful processes prevailing, we are expending our very substance and daily adding to a burden under which generations to come will stagger. These considerations should increase our regard for the business of farming and our interest in it. We should all rejoice at the revival of agricultural studies and the increasing number of able men who are making them their life's work. Let me cordially invite continued contributions to the proceedings of this section—upon foods, fabrics, forestry, industrial education and other topics closely related to our material welfare.

In Section E (Geology and Geography), Vice-President Gilbert, in an address on "The Work of the International Congress of Geologists," described the movement toward a uniform nomenclature begun in Paris in 1878. The congress last met in 1885 at Berlin. The next meeting will be held in London in 1887. In Section C (Chemistry), Vice-President Prescott discussed the "Chemistry of Nitrogen as Disclosed in the Constitution of the Alkaloids." In the evening Professor Morse discussed "A Decade of Evolution" (in America during the last ten years). In Section D (Mechanical Science), Vice-President Cox gave the sectional address on "The Necessity of Scientific Training for Engineers." We reproduce the *Tribune's* abstract:

"An occasion like the present, when an engineer who is really a business man is called upon to preside over a scientific body, naturally gives him much food for reflection. Having no scientific specialty, he can only offer some thoughts that have occurred to him during the time he has been engaged in active work. Engineering, though the youngest of the professions, is already divided into civil, mining, mechanical, and other branches, but there is another kind of sub-division taking place. To some engineers it is a science, to some a profession, to some a business. The words "Engineer" and "Engineering" are derived from the Latin *signo*—to bring forth, to produce—they involve the idea of progress or evolution, not of creation. This may be called the age of engineering, as it is called the age of progress. The engineer is deeply indebted to those scientists who during the past hundred years have been determining, experimentally, the data which are indispensable to him and to that other class who have compiled and discussed mathematically the data thus obtained.

Many of these men have done their work, which was often appreciated by a select few only, at their own expense and at a great sacrifice to themselves. They are among the noblest and bravest of the soldiers of science. The first practical engineers were developed in the field or in the workshop. They had generally little preparatory or scientific training, and learned what they could while engaged in the active duties of their profession. Their great success is thought by some to show the uselessness of scientific training for the engineer. This is a great error. They became what they did in spite of, not because of, their want of scientific training. "But there were giants in those days." But the importance of such study is shown by the large number of technical colleges of high reputation in the United States. Engineers of the present day may be divided into three classes. First, that of the scientific engineer. This includes professors, experimenters, compilers, and those now in charge of the physical and technical laboratories of the great railroads and industrial establishments. They are really men of science. Second, that of consulting engineer. This includes the engineers of railroads, mills, mines, etc., who design and superintend the technical part of the work of such establishments. They answer more nearly to the popular idea of an engineer.

"The third class, now becoming a most important one, includes the business engineer—that is, men who will engage to build a bridge or do any other engineering work, furnishing plans, etc., and guaranteeing to accomplish certain required results for a given sum of money, taking all risks. At the present time one of the most important, vigorous, and interesting discussions engaging the attention of the engineering world is that of technical education, upon which there is a great divergence of opinion as to the proper relation of theory and practice in the training of the students of engineering. Men of great ability and experience differ widely upon this subject. In law, theology and medicine there is practically a system of study agreed upon, although there is not of course unanimity as to details. But in engineering this is not the case; some consider that the young man who does not go to college, but grows up in an industrial establishment or in a railroad corps will advance better than one who goes to a technical school; others maintain that if a man is well grounded in theory he can pick up his practical knowledge anywhere. These are the extremes, but between them there are a great variety of views, all held by men of ability and experience. If a number of lawyers, doctors, and clergymen were to try to lay out a single course for every student who desires to enter either of the three professions, they would find it difficult to agree, and if they did the course suggested would be bad for every one, though some of those who followed it would gain a good position in their profession on account of their special mental capacity. May we not be unconsciously endeavoring to frame such a course for students of engineering to follow, which in consequence of the broad field from almost pure science to pure business, now covered by that profession, it is impossible for any student, in the short time at his disposal, to go through except in a most superficial way? May it not be necessary for the student to decide earlier in his college life whether he is going to be a man of science or a man of business, and then to devote more time to those studies specially required for the career he intends to embrace? By doing this may he not only be prevented from wasting much of his valuable time, but also avoid superficial study which is so bad for a young mind? The highest duty of the engineer is to save waste. If the man who makes two blades of grass grow where one grew before deserves well of mankind, how much more he who prevents the useless labor of sowing seeds that may grow up into worse than useless weeds. I hope you will deem this question worthy of your thought, interested as I know so many of you are in the subject of technical education."

The Sections and papers are as follows:

Section A (Astronomy)—Professors Wilson, Princeton, and Bigelow, Racine College, Wis.; Mr. Kershner, Lancaster, Va.; Dr. Van der Weyde, New York, three papers; J. A. Brashear, Allegheny, Pa., three papers; Professor Macfarlane, University of Texas.

Section B (Physics)—Professor Davis, Harvard; W. F. Magic, Princeton; A. B. Johnson, of the United States Lighthouse Board; Messrs. Michelson and Morley, Cleveland; Professor Rogers, Bowdoin University, Maine, nine papers; Dr. P. H. Van der Weyde, New York, two papers; Professor Macfarlane, University of Texas; Professor Skinner, Massachusetts Institute of Technology; Dr. W. Thompson, Jefferson Medical College; F. P. Dewey, Smithsonian Institution; C. F. de Landero, Guadalajara, Mexico, and Elias E. Ries, New York; G. H. Williams, of Syracuse.

Section C (Chemistry)—Miss Helen C. de S. Abbott, Philadelphia; Messrs. Power and Weimar, Madison, Wis.; Professor J. M. Norton, Massachusetts Institute of Technology; Professor E. Mason, Polytechnic Institute, Troy; Professor Morley, Cleveland; A. L. Green, Lafayette, Ind.; Professor Herrick, State College, Pa.

Section D (Mechanical Science)—Professor Thurston, Cornell, two papers; Professor Eddy, Cincinnati College, Ohio, two papers.

Section E (Geology and Geography)—Professor Richard Owen, New Harmony, Ind., two papers; Dr. Julien, Columbia; Professor Claypole, Akron, O., four papers; Professor James, Miami University, O., two papers; H. P. Cushing, Cleveland, O.; Professor H. S. Williams, Cornell; R. T. Hill, United States Geological Survey; Professor Orton, Ohio State University; C. Wolcott, United

States Geological Survey; Professor Scott, Princeton; G. H. Williams, Syracuse; the Rev. H. C. Hovey Bridgeport, Conn.; Professor Comstock, Champaign, Ill.; C. S. Prosser, Ithaca; I. E. Willett, Macon, Geo.

Section F (Biology)—Professor Mills, McGill University, Montreal; Dr. C. P. Hart, Wyoming, O.; Professor Scott, Princeton; Dr. Kost, University of Florida; R. P. Whitfield, American Museum of Natural History, New York; Dr. Britton, Columbia; Professor Wilder, Cornell; S. E. Warner, Newton, Mass.; Dr. Baur, New Haven, Conn., two papers; Professor Cope, Philadelphia; Dr. Rusby, New York.

Section G was united with the preceding section.

Section H (Anthropology)—Professor Mills, McGill University, Montreal; Dr. Hart, Wyoming, O.; Professor Kost, State Geologist of Florida; Miss F. C. Babbitt, Coldwater, Mich.; the Rev. W. M. Beauchamp, two papers; Dr. de Hass, two papers; Thomas Wilson, Washington; Professor E. H. Perkins, Burlington College, Vt., two papers; Professor Claypole, Professor Putnam, Harvard.

Section I (Economic Science and Statistics)—Professor Leeds, Stevens Institute, one paper.

On Friday the Sections were busy with their assigned subjects. The titles of papers of more especial interest to our readers were: In B, "A Method of Telephone Communication between Ships at Sea," by Professor L. I. Blake, of Terre Haute, by sound-producing apparatus attached to vessels and worked below the surface of the water, the ships having also apparatus for receiving and reproducing the sounds. "The Strength of Nicaraguan Woods," by Professor R. H. Thurston, of Sibley College, Cornell University. The conclusion reached is that there exists in Central American forests an enormous store of timber of remarkably fine quality, and that we may find after a few years, when our own forests have been so denuded as to make it necessary to look elsewhere, a most important safeguard against that timber famine which seems to hang over our heads. "The American System of Water Purification," Professor Albert R. Leeds, of the Stevens Institute, of Technology. "The Geology of New York City," by Professor D. S. Martin, Section —. "The Economy of Food," by Professor W. O. Atwater, of the University of Michigan, Section I, and "The Food of Workingmen and its Relation to the Work Done," by the same author. Friday evening there was a reception to the delegates at the Metropolitan Opera House, and Saturday a water party with a sail around the Upper Bay, given by Mrs. J. S. T. Stranahan, of Brooklyn.

The meetings will be continued through August 16.

MR. BELL AND MR. FRERET IN THE OFFICE OF SUPERVISING ARCHITECT.

THE following extracts from a letter by a Washington correspondent to the Milwaukee *Journal* are of interest:

"The sudden shift made in the office of Supervising Architect, by which Mr. Bell, who was appointed by President Arthur in 1883, goes out and Mr. William A. Freret, of New Orleans, goes in, caused quite a stir. This office is one of peculiar importance and its incumbent has an influence that extends over the whole country. A poor architect in this place may stud the land with permanent monuments of unsightliness, while one of skill and artistic capacity may do untold benefit. Mr. Bell will rank as one of the latter class. He has, in the four years of his incumbency, wrought a marvelous change in the general character of the public buildings erected by the general Government. His designs are rational, artistic, and permanently pleasing. Mr. Freret, who succeeds him, is also by reputation a man who has made the world more beautiful by his art. He is a native of Louisiana, born in New Orleans, and now in his fifty-fourth year.

"He graduated at the University of Virginia in 1849, and then perfected himself in engineering and architecture by studying abroad for several years. Thirty years before the war his father was Mayor of New Orleans, and the family has always enjoyed a high social standing. When the war broke out Freret entered the Confederate service promptly and soon attained the rank of Major of Engineers, serving under Kirby Smith. Many buildings in New Orleans attest his genius in his profession. The New Orleans Savings Bank building, designed by him twenty years ago, proved his skill. Most of the iron fronts on famous Canal Street are his work. The magnificent block known as the Moresque Building on Camp Street and Lafayette Square was his conception, intended to be purely Moorish in scope and details. It is beyond all doubt the most successful copy from the Moorish ever attempted in America. Over half the prominent churches in New Orleans were designed by Major Freret, and some are masterpieces.

"As Supervising Architect, Major Freret will have the opportunity Mr. Bell so well used, to improve the character of Federal buildings everywhere. Congress gives something like ten million dollars every year to the erec-

tion of buildings to accommodate customs, judicial, and postal officials. With such a vast sum running through his hands, the Supervising Architect is under a great burden of responsibility. Mr. Bell has given special attention to designing tasteful buildings for Southern cities. The South has, by the war and the backward condition of business in her various cities, hardly justified the expenditure necessary to provide good Federal buildings."

PERSONAL.

JOHN N. RISDON, founder of the Risdon Iron-Works of San Francisco, died at Oakland, Cal., July 31.

MESSRS. J. T. FANNING and H. H. Harrison have been appointed consulting engineers to the Water Board of Minneapolis.

ASSISTANT ENGINEER ALBERT W. STAHL and Ensign George W. Street, U. S. N., will be sent to Europe to study the construction of ships of war.

THOMAS J. WHITMAN, of St. Louis, will visit Milwaukee to consult with City Engineer G. H. Benzenberg, of Milwaukee, about a plan for the intercepting sewers.

ANDREW R. TREW, resident engineer of the New York Central Railroad at Tonawanda, N. Y., died suddenly August 11, aged 62 years. Mr. Trew had charge of the construction of the bridge at Niagara Falls.

HORACE ABBOTT, founder of the Abbott Iron-Works, Baltimore, died in that city on August 8, aged eighty-one years. Mr. Abbott was born in Massachusetts, and was related, on his mother's side, to Eli Whitney, inventor of the cotton-gin. In 1846 he moved to Baltimore and began the manufacture of shafts, cranks, and other iron-work for steam-vessels. He retired from active business some years ago.

CHIEF ENGINEER GEORGE W. MELVILLE, U. S. N., has been appointed to the head of the Bureau of Steam Engineering of the Navy, succeeding Engineer in Chief Charles H. Loring, who has resigned. Mr. Melville, who is now in his 47th year, has gained a great reputation for daring, persistence and energy, by the manner in which his work in the Arctic region has been done. It is believed to be due to him in large measure that the unfortunate "Jeannette" crew were in part saved from the Lena Delta of Northern Siberia; and he has been honorably mentioned for his work in the rescue of the Greely's Lady Franklin Bay expedition. It is reported from Washington that he has also a high reputation for knowledge and skill in the technical part of his profession.

POOR'S DIRECTORY OF RAILWAY OFFICIALS.

A SUPPLEMENT to Poor's Manual of Railroads, second annual number, 1887, has just been issued, containing lists of the officers of all railways in North America, and of the leading organizations auxiliary to the railway system, lists of officers of the South American and British railways, etc. New York, 1887. Price, \$2.

The second annual number of this work is much enlarged over the first number, and presented in more convenient form. It is a surprisingly complete record of the officials, including engineers and master mechanics of steam railroads, of street and horse railroads, and even of lumbering and logging railroads. It contains also directories of the officers of companies manufacturing railway supplies, and alphabetical lists of railway contractors. To all who wish the addresses of railway men the book is invaluable.

MESSRS. OTIS BROTHERS & CO., of New York, have received an order to begin the construction of two hydraulic elevators for the new Eiffel Tower now in course of erection in Paris, which is to be 1,000 feet high, and is to be completed in time for the World's Exposition in Paris in 1889. Special designs were submitted by Otis Brothers & Co., in conjunction with English, French, and German elevator manufacturers. There will be six elevators, four running to a point five hundred feet above the ground and two running upward from that point.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

MESSRS. BRUCE & MORGAN, architects, of Atlanta, Geo., have been selected by the Board of Trustees as architects of the new A. & M. College at Auburn, Ala.

THE Committee on Buildings of the Board of Chosen Freeholders of Hudson County, N. J., invite architects to submit plans in competition for a Hall of Records. For the best plan a premium of \$300 will be given. The building is to be 50x75 feet, two stories high, and fire-proof. Plans should be submitted before September 15. John Kelly, Chairman of the Committee, Jersey City, will give further information.

LYNN, MASS.—Common Council has voted to ask certain local architects to submit plans for a high-school building. Site and building will cost about \$100,000.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 295-297-298-301.

WATER. SEWERAGE, ETC.

BELAIR, MD.—Our correspondent writes: "Contractor W. W. Taylor, who has constructed water-works and supplied towns with water, has prospected here, with a view to supplying this town, but I do not think that anything as yet has been determined upon."

CANISTEO, N. Y.—Our correspondent writes: "The job has been let for the water-works of this town, and work commenced on digging the reservoir, and will start laying pipe soon. The main pipe will be ten inches inside measure, and branch pipes from that down to six inches. Capacity of reservoir two million gallons, and is built on a hill on quite a rise of ground."

MARTIN'S FERRY, O.—Our correspondent writes: "We have a set of water-works in course of construction. The plant will be done about September 1. Pumping capacity is 1,250,000 gallons in 24 hours; reservoir capacity, 3,000,000 gallons; city's population, 7,000, with extensive manufactories."

MASSFELD, MASS.—At the district water meeting August 9 W. A. Copeland was chosen Moderator. The vote to see if the town would accept the charter granted by the Legislature a year ago to build water-works for fire and domestic purposes resulted in 149 in favor to 65 against, six votes over the necessary two-thirds.

FLUSHING, L. I.—The contract for a 2,000,000 gallon pumping-engine has been given by the Village Trustees to the George F. Blake Manufacturing Company at \$8,500.

NEW YORK.—Messrs. Charles Julien and Henry Cerrier, French civil engineers, are examining the water-supply of this city.

PENSACOLA, FLA.—Colonel George E. Waring, of Newport, R. I., will make plans for a system of sewerage here. He has made a preliminary survey.

YOUNGSTOWN, O.—wants three miles of cast-iron water-pipe. The Water-Works Trustees have found great difficulty in obtaining any.

ST. PAUL, MINN.—The Water Commissioners have advertised for twenty-five tons of 36-inch lead pipe, extra strong, and twenty-five tons of pig lead; bids to be opened August 15.

LITTLE ROCK, ARK.—Bids are advertised for about one mile of sewers in Sewer District No. 12. To be the Waring system. Fred. J. Rickson is City Engineer.

MINNEAPOLIS, MINN.—The Water Board is advertising for water-pipe and pig lead.

CLEVELAND, O.—The Board of Water-Works Trustees have ordered about 5,000 feet of water-pipe laid.

DUBUQUE, IOWA.—Dr. Greene, advisory physician to the Board of Health, recently addressed City Council, urging the importance of the early construction of a good sewerage system.

KUTZTOWN, PA.—It is proposed to organize a Borough Water Company and build works for this place. Examinations of sources of supply have been made.

CARTHAGE, N. Y.—The village has been looking into methods of obtaining a water-supply, and now has received a proposition from the Canastota Water Company to furnish water from Black River or Pleasant Lake; the town to take seven hydrants at \$60 per year each, and to pay \$60 per year for additional hydrants. No definite action has been taken.

ST. CLOUD, MINN.—The City Council, August 1, accepted an ordinance from Phelps & Sykes, of Minneapolis, as amended, and the city attorney was instructed to draw a contract for the sale of the water-works with those parties. Work on an extension will immediately begin, and several miles of mains will be laid within sixty days.

WOODLAND, CAL., has given up for the present the idea of constructing a sewerage system.

SAUGERTIES, N. Y.—Yesterday, August 12, the town voted on the question of the purchase of the works from the Private Water-Works Company. We have not yet learned the result.

MODESTO, CAL.—Articles of incorporation of the Modesto Town Improvement Company have been filed. The capital stock is \$83,880, divided into 4,194 shares. The directors are George W. Spencer, Charles Maze, Jr., J. S. Alexander, Charles Page, and Charles P. Eells. It is the purpose of the company to buy and sell water-rights and real estate in Stanislaus County.

MANKATO, MINN.—Council has decided to build a large reservoir for the water-works system. Five lots will be purchased on Agency Hill, and bids for the construction of the reservoir will be advertised for at once. The improvement, including about one-half mile of pipe, and laying, will cost \$10,000. The City Council advertises for bids for the purchase of \$15,000 park bonds and \$10,000 sewer bonds, both to be issued in sums of \$1,000, to run twenty years and draw five per cent. interest.

ORANGE, N. J.—The Hyatt Filter Company, on August 8, sent an estimate of the cost of filtering apparatus to the Common Council. They offer to sell the city four filters, with a capacity of 1,000,000 gallons per day, for \$3,000 each, which, with the necessary piping, connections, etc., would cost the city \$15,000. The proposal was filed.

DANVILLE, MASS.—New water-works are to be established here.

FREDERICK, MD.—An increase in the water-supply is contemplated.

MINONK, ILL.—\$10,000 has been appropriated for water-supply.

ALBANY, N. Y.—Proposals are ordered for the Beaver Creek sewer. It will be 8x9 feet, 4,000 feet long. Address Horace Andrews, City Engineer.

SOUTH FRAMINGHAM, MASS.—On August 3 a report was received from S. C. Heald, C. E., on the site of the town. He proposed pipe sewers with brick outfall sewer and irrigation, estimating the cost at \$140,000.

HARRISON, N. J., wants propositions for sewerage of the streets.

READING, PA.—The Committee on Sewers will recommend to Councils the filling and covering of the following water-courses: Oley Street from Seventh to Ninth, \$8,000; Washington, beginning at Second, thence to Court Street and the River, \$10,000; from Front and Spruce Streets to the Canal, \$1,500; Culvert from Spring Garden Street to the P. & R. Railroad, \$2,500; Nicolls Street from Spring to Oley, \$30,000.

WASHINGTON, KAN., wants works.

GREENLEAF, KAN., will have water-works.

WARE, MASS., will extend its water-works.

CIMARRON, KAN., has voted \$50,000 for water-works.

CENTREVILLE, IOWA., is sinking a \$10,000 well for water-supply.

HUNTINGDON, IND.—City Council is examining systems of water-supply. Address them at once.

LOWELL, MICH.—A water company with \$30,000 capital has been organized here.

SACRAMENTO, CAL.—The Committee of the Sacramento Improvement Association has reported recommending examinations for sites of wells for increased water-supply, and the association has voted the money needed to make the investigation. Address W. A. Briggs, Chairman of the Committee.

PORTSMOUTH, VA.—Newark, N. J., parties are considering the advisability of introducing water-works here.

RIVERSIDE, CAL., will have water-works, also gas-works.

ANAMOSA, IOWA., will have water from an artesian well.

NEW ROCHELLE, N. Y.—A strong movement has developed here for the early beginning of a sewerage system. Address President Banks about the matter. A special committee will soon be appointed.

LONG ISLAND CITY, N. Y.—The Water Board of Long Island City met August 8. On motion of Mayor Gleason it was decided to lay five miles of water mains in the Third Ward and the German Settlement. The improvement will cost about \$50,000.

MILWAUKEE.—James Foley, chief of the Fire Department, will purchase 3,000 feet of rubber hose and 2,000 feet of cotton "jacket" hose in the open market.

Water-mains will be laid in Randall Street, from Cold Spring Avenue to Chestnut Street; also in Lee Street, from Humboldt Avenue to Weil Street, in North Avenue from 18th to 19th streets.

Plans and estimates for the cost of a flushing tunnel, with the capacity of 300,000,000 gallons of water daily, the tunnel to enter the river below the dam, will be prepared by the City Engineer.

A plan for the extension of the North Menomonee Inter-cepting sewer north of the North Menomonee Canal, for the purpose of intercepting the sewers emptying into the Menomonee Valley from the north, has been prepared by the City Engineer.

LA MARS, IOWA.—Address M. A. Moore, Mayor, with proposals for constructing water-works under a franchise.

GREENSBORO, N. C., will receive bids until September 1 for the construction of water-works under franchise. Address Mayor R. R. King.

VAN WERT, O.—Plans are wanted for a sewerage system here.

WATERTOWN, N. Y., will receive bids for construction of water-works until August 20. See our Proposal Column.

ABERDEEN, DAK., is agitating the construction of sewers.

WHITEWATER, WIS.—Bids for the construction of water-works are wanted by H. S. Salesbury, City Clerk.

OLNEY, ILL.—Mayor James E. Wharf will receive bids at once for constructing water-works under franchise.

GAINESVILLE, FLA., City Council has received a proposition from W. A. Jeter, of Brunswick, Geo., for the building of water-works. No action has yet been taken. It is proposed to issue proposals for bids.

NASHVILLE, TENN.—At the opening of bids, August 9, for the construction of a reservoir for the water-works, the lowest was found to be that of Whitsitt & Adams, of Indianapolis, at \$330,921, the highest from a Nashville party, at \$741,180. The contract was awarded to Whitsitt & Adams.

EAST TAWAS, MICH.—Our correspondent writes: "The village voted to bond the place for \$25,000 for water-works. A plan has been decided on and bids will be received for construction of the water-works, which are to be completed this year."

TITUSVILLE, FLA.—The citizens have voted in favor of a water-works. Address Pritchard & Sweet.

FORT WAYNE, IND.—The Mayor, City Attorney, and City Civil Engineer have been appointed a committee by Council to confer with Messrs. Buss, Fleming & Simmons in regard to purchase by the city of certain water-properties; also to consider the question of water-supply in general, and the advisability of sinking wells as a possible source of supply.

MANKATO, MINN.—A large reservoir for water-works system will be built. The improvement, including one-half mile of pipe and laying, will cost about \$10,000. Williams & Hanlon will begin sewer work at once.

MINNEAPOLIS.—The Council Committee on Sewers decides favorably to building a sewer connection with the North Minneapolis sewer tunnel from Twenty-fourth Street and Lyndale Avenue, the principal object being to drain about 100 acres of low land.

WATERBURY, CONN.—It is reported that Mayor Boughton and City Engineer Weld, of this city, are considering the practicability of constructing a system of sewers through the Naugatuck Valley, from Winsted to the Sound. The proposition is to unite Waterbury, Winchester, Torrington, Ansonia, Derby, Birmingham, and other towns in the construction of a great intercepting sewer, relieving the Naugatuck River from the sewage pollution it now suffers from.

PANA, ILL.—On August 8, City Council authorized the Mayor to appoint a committee to obtain estimates on the cost of constructing water-works.

FRESNO, CAL., is agitating the question of sewerage, and estimates the cost at \$50,000.

KALAMAZOO, MICH.—The Committee on Fire and Water will advertise for proposals for sinking a well, connecting several wells, water-pipe, etc. Address Engineer Pierson.

LOS ANGELES, CAL.—The Barton Land and Water Company was incorporated August 5 to buy and sell land and water in the San Bernardino Valley; incorporators, W. P. McIntosh, C. K. Day, H. M. Barton, and others.

GAS. STEAM, BUILDINGS, ETC.

LE MARS, IOWA.—A company has been formed to bore for gas or oil, with capital stock of \$10,000. The contract has been let, and work on a 2,000-foot deep hole will be commenced inside of thirty days. The company have leased 3,000 acres of land in the vicinity of Le Mars.

AMSTERDAM, N. Y.—The lighting of the streets by electricity is agitated.

HALIFAX, N. S.—The bids recently received for lighting the city by electric-lights have been rejected and new proposals will be advertised for.

PHILADELPHIA.—The Steam-Heating Company was chartered August 8 at the State Department at Harrisburg, with a capital of \$400,000, divided into shares of \$100 each. Horace Pettit, of Jenkintown, is treasurer of the new company and owns 300 shares. The other shareholders, each of whom owns twenty shares, are: William L. Nevins, C. F. Henry, Thomas Stuart, Robert P. Field, of Philadelphia, and H. P. Gill, Woodbury, New Jersey. A central supply station will be built and mains laid at once.

FORT SCOTT, KAN.—A syndicate is sinking a gas-well on the Jake Hamlin farm. Glass works will be built.

ROCHESTER, PA.—The Heat, Light and Power Company has made a contract with the Baden Gas Company for a supply of natural-gas. P. Moran, of Pittsburgh, has the contract for laying the necessary pipe.

LAS VEGAS, N. M.—A natural-gas company has been organized here.

FARIBAULT, MINN.—Common Council has granted a ten-year exclusive franchise to the Thomson-Houston Electric Light Company of Boston.

RICHMOND, MICH.—A company has been organized to sink gas-wells. Work will be begun next week.

CANASTOTA, N. Y.—The election of August 5 on the question of raising \$2,000 for electric-lights in the streets resulted in a tie vote. Another election will be held.

WHITE PLAINS, N. Y.—The articles of incorporation of the People's Gas-Light Company, which will furnish illuminating gas to the citizens at \$1.50 per 1,000 feet, were filed in the County Clerk's office August 2. The company has been granted a franchise to lay mains. The directors are Charles W. Ball, President; Charles T. Brooks, and George Olney.

SALEM, O., will have the streets lighted with electricity.

MEADE CENTRE, KAN.—Incorporated is the Mead Centre Gas, Fuel and Water Company, by O. B. Hamilton and others; capital, \$50,000.

LOUISVILLE, KY.—The Fisherville Natural-Gas Company is incorporated by S. E. English and others.

ANDERSON, IND.—The Citizens' Gas Company has been incorporated by John L. Forkner and others; capital, \$50,000.

GREENVILLE, S. C.—A company will organize to introduce the Thomson-Houston electric-light for the streets. Asbury & Son are interested.

DRE MOINES, IOWA.—The Capital City Electric-Light Company and the Thomson-Houston Company of this place, have been asked to submit bids for at least 100 arc lights.

RALPHIGH, N. C.—See our Proposal Column for notice of the opening of bids for furnishing steam-heating apparatus for capitol, Supreme Court and library buildings.

STILLWATER, MINN.—A contract has been made with the Stillwater Electric-Light Company to light the streets with electricity.

ALBERT LEA, MINN.—A company has been formed to sink gas-wells here.

JAMESTOWN, DAK.—Proposals will be received until August 27 by the Trustees of the North Dakota Hospital for the Insane for steam-heating apparatus and water-supply. F. E. Jones, Secretary.

OWENSBORO, KY.—The Gas-Works are to be almost entirely reconstructed and enlarged, at a cost of about \$50,000. Address H. D. Fitch for further information.

DALLAS, TEX.—The Southern Electrical Construction and Supply Co. will put in a 650 incandescent light Westinghouse engine, and fifty arc lights immediately.

WACO, TEX.—The Southern Electrical Construction Supply Co., of Dallas, Tex., will erect a plant here.

MINNEAPOLIS.—The Council Committee on Gas have considered bids for furnishing gas and electric-lights for the next five years. The bid of the Minneapolis Gas Co. was \$12,144.54 for 777 lights. The Brush Electric Light Company's bid was \$180 per light for from 400 to 500; diminishing to 1,000 or more lights at \$140 each. The committee recommended that the Brush Co. be awarded 400 lights at \$150 per year for five years; that they shall cut down the electric mast to 150 feet and provide it with eight lights of 2,000-candle power each, and reduce the annual cost from \$4,000 to \$2,000.

RAILROADS. BRIDGES. CANALS.

COLUMBUS, MISS.—The Tombigbee Railroad Company will let the contract for the construction of the road in a few days. For information, address B. A. Vaughn immediately.

SMITHFIELD, ALA.—The Elyton Land Company has secured the right of way for the belt-line railroad.

HARRISBURG, PA.—City Council has closed the contract with the Barber Asphalt Company for paving Market Street. This matter has been for some time under discussion.

RAILROAD.—Contractor Ryan, of Philadelphia, has received the contract for building seven miles of railroad from Pleasantville to Brigantine Beach, N. J.

HOT SPRINGS, ARK., has voted right of way to the New Orleans, Natchez, and Fort Scott Railroad.

BOSTON.—Surveys for the Meigs Elevated Railroad have already begun between Bowdoin and Harvard Squares. The section will be about eight miles long. Construction will begin the middle of September.

SYRACUSE, N. Y.—A stock company, including Col. A. C. Chase, A. C. Belden, H. J. Maury, William A. Sweet and others will build a drive along Onondaga Lake. Howard Soule, Jr., C. E., has made surveys, and estimates the cost at \$25,000 to \$35,000.

COATESVILLE, PA.—The Pennsylvania Railroad will build a stone arch bridge over the Brandywine at this place.

FLUSHING, L. I.—On August 8 the franchise for the street railroad in College Point was sold to the Flushing and College Point Railroad Company.

TACOMA, CAL.—Nelson Bennett has the franchise for a street railroad here.

HARRISBURG, PA.—City Engineer Cowden has prepared an estimate of the cost of paving certain streets, making the cost to be about \$74,000 for Medina stone, and lesser prices for other stone, down to \$60,000 for asphalt.

ST. PAUL, MINN.—The contract for the uptown bridge has been awarded to C. L. Strobel at \$340,324. A legal contest is likely to result, as other bids are lower.

ALLEGHENY, PA.—The Allegheny Committee on Streets and Sewers has instructed the City Solicitor and City Engineer to see that the Pittsburgh, Fort Wayne and Chicago Railroad Company build a viaduct across their tracks on West Market Street. A resolution has been adopted instructing the City Controller to advertise for proposals for furnishing and placing 2,000 street signs.

YONKERS, N. Y.—Address Oliver O. Stahlnecker about a movement here for a railroad through the city.

SALT LAKE CITY, UTAH.—Edmund Wilkes and associates will ask for a franchise permitting the construction of an electric railroad.

HINDOSTAN, IND.—It is proposed to erect a \$40,000 bridge over White River at this place. Address the Commissioners of Martin County.

ST. PAUL.—The Board of Public Works has awarded the following contracts: Grading York Street, from Forest to Clark, and Sims, from Forest to Edgerton, to R. L. Schutte for \$10,675; paving alley in Park Place adjacent to Folsom & Murray for \$650; paving alley in block 27, Woodland Park, to Folsom & Murray for \$1,650.

The board has reported in favor of the following improvements: Slopes on Dale Street at \$200; grading Marion Street from Atwater to Maryland; Woodbridge, from Atwater to Maryland; Milford, from Rice to Gaultier, at \$8,694; grading State Street from levee to Isabel Street, at \$45,700; grading Brainerd Avenue from Arkwright to Edgerton Street, at \$2,800.

RAILROADS INCORPORATED.—Tellico R. R. Co., Knoxville, Tenn., by R. L. Bright, T. E. McCroskey, A. S. Thomas, J. L. Clift, and J. D. Bright. The company is organized "for the purpose of constructing a railroad from an available point on the State line between North Carolina and Tennessee, to the city of Nashville, or to the Cincinnati Southern Railroad at or near Emory Gap in said State."

Clinton and Big Valley Railroad Company, Knoxville, Tenn.

The Camak and Wadesboro Railroad Company, Camak, Geo. G. H. McMaster, J. M. Beatty, John Bratton, James Jones, William S. Hall, D. L. Glenn, W. N. Mason, T. W. Woodward, R. M. Huey, and W. W. Ketchum, incorporators.

Desha and Eureka Springs Railroad Company. The road will begin at Pendleton, Ark., on the Arkansas River, and run to Eureka Springs, a distance of 210 miles. The capital stock is \$3,150,000. Board of Directors: G. P. Banks, Boston, Mass.; E. E. Pratt, Manchester, Mass.; W. E. Stowe, Belmont, Mass.; H. M. Cross, Boston; James Murphy, W. B. Dutton, H. Waldon, J. M. Whitehead, and J. M. Barnard, of Desha County.

RAILROAD.—Articles of incorporation have been filed by the San Gabriel Valley, Cal., Rapid Transit Company. The purpose is to build a railroad, to be operated by steam or electric power, from Los Angeles to Monrovia. The estimated length is fifteen miles. The directors are J. de Barth Shorb and J. R. Dobbins, of San Gabriel; F. Q. Story, of Alhambra; W. N. Monroe, of Monrovia; J. J. Gosper and H. A. Unruh, of Los Angeles; and J. D. Gilchrist, of Pasadena. J. de Barth Shorb is president, H. A. Unruh secretary, and F. Q. Story treasurer. The capital stock is \$250,000, of which \$15,000 is subscribed.

RAILROADS.—Incorporated is the Missoula and Bitter Root Mountains Railroad, of Montana. Also the Salt Lake Valley and Eastern Railroad, of Utah.

DENVER, COL.—The Denver City Railroad Company will lay its line across the viaduct to Argo.

LOS ANGELES, CAL.—The Los Angeles Cable Railway Company are advertising for 50,000 cubic yards of broken stone and 10,000 iron yokes. W. R. Davis will be in charge of the work.

NEW BRITAIN, CONN.—A new bridge will be built at the Black Rock crossing of the New England Railroad.

HARTFORD, CONN.—D. H. Andrews, of the Boston Bridge Works, has the contract for building an iron bridge over the Connecticut for the New England Railroad Company. The estimated cost is about \$75,000.

RAILROAD.—The State Line and Indiana City Railway Company has been incorporated by J. I. Torrence, C. N. Towle, W. H. Gastlin, James S. Prentiss, and Thomas W. Johnston, with a capital stock of \$500,000, for the further improvement of East Chicago. It will run from the Indiana State line to Indiana City, a distance of about twenty-five miles, and will be used as a connecting link for several roads.

MILWAUKEE, WIS.—The Dummy line to Whitefish Bay has its time for completion of the road limited to June 1, 1888.

The West Side Railway will abandon horses and take up the cable project. W. Becker is now in the East to look up the matter.

CHICAGO.—The Mayor has approved the ordinance providing for the Jackson Street viaduct. The bridge, viaduct, and abutment are to be constructed upon plans and specifications agreed upon by the Mayor and the Chief Engineer of the railroad company. The payments for the cost and expense of the iron viaduct and abutment are to be made by the railroad company from time to time as the work progresses.

MAYPORT, FLA.—The Jacksonville and Mayport Railroad Company will build a standard-gauge road.

RAILROAD.—Articles of incorporation of the Chicago, St. Paul and Kansas Railroad have been filed in the office of the Secretary of State, Kansas City. The capital stock is \$15,000,000. The estimated length of the main line is 350 miles. Three branches are also to be constructed, two of them 100 miles long and one 250 miles long.

ALBANY, N. Y.—The Kinderhook, Valatie and Stuyvesant Railroad Company has been incorporated; capital stock, \$150,000. The directors are Charles D. Haines, Daniel D. Wylie, Samuel Shethar, William Frister, and John B. McGeorge, of New York City; Frank H. Skeele, of Brooklyn, and Benjamin F. Ingraham, of Elizabeth, N. J.

TOPEKA, KAN.—Incorporated are the Osawatimie Building and Loan Association, with a capital stock of \$100,000. Directors: A. H. Knapp, J. C. Chestnut, H. B. Smith, D. Breneman, and C. S. Bixby.

Marion Coal, Gas and Mining Company with a capital stock of \$10,000. Directors: John F. Carter, W. W. Case, W. A. Stamford, S. C. Orr, and Levi Billings.

POUGHKEEPSIE.—Incorporated is the Poughkeepsie, Hartford and New England Railroad Co. The new road will run from Poughkeepsie in a north-easterly direction through Hibernia, Stanfordsville, McIntyre, Stiss, Attlebury, and Pine Plains to a point near Silvernails Bridge, where it connects with the Hartford and Connecticut Western, now owned by the Philadelphia syndicate. It will be about twenty-eight miles in length and the capital stock of the company is \$285,000.

ALBANY, N. Y.—Articles of association of the New York and Long Island Railroad Company were filed July 30 with the Secretary of State. Capital stock \$100,000. The road is to run from a point near the line of Borden Avenue in Long Island City, distant about one mile from the East River; thence partly underground and partly in cutting to the East River; thence under the East River by means of a tunnel and under streets and lands in the city of New York to a connection with the New York Central and Hudson River Railroad at the corner of Ninth Avenue and Thirtieth Street, with a branch on the north to a connection with the New

York Central depot, and a branch on the south to connect with what is now known as the Hudson River tunnel in the vicinity of Washington Square, New York. The directors are as follows: Walter S. Murner, Thomas Rutter, Augustus C. Gurnee, Roy Stone, Malcolm W. Nevin, George R. Sheldon, Frank K. Hain, and Oliver W. White, all residents of New York, and Henry S. Kindekoper, Philadelphia; E. Platt Stratton, College Point; Robert Townsend, Oyster Bay.

RAILROAD.—The New York and Boston Rapid Transit Company has sixty men in four surveying parties at work in Massachusetts, Connecticut, and New York, and a direct line between Boston and New York will be located, ready for contracts, by August 30. Negotiations are complete for constructing the line. The Boston and Maine and Boston and Providence terminals will be used. Forty millions of bonds are authorized. The highest estimate of cost is \$37,000,000. The New York terminals at Fifty-ninth Street and Broadway require \$2,000,000, and the northern connections require \$2,000,000. The main line starts from the Lowell station, Boston, runs through Willimantic, New Haven, and Bridgeport, entering New York at High Bridge, going down the west side of Central Park.

TUSCALOOSA, ALA.—The contract for grading the first ten miles of the Tuscaloosa Northern Railroad was let August 8 to Messrs. Robert Squire & Co., of Birmingham and Cincinnati. Work will begin in ten days after the contract is signed.

BIDS OPENED.

WHITE PLAINS, N. Y.—The following estimates were received by the Heating Committee of Westchester County Court-House and Jail, White Plains, N. Y. Plans and specification for the work were prepared by W. M. Mackey, Newark, N. J.

BIDDERS.	Amount of Estimate.	Total Radiating Surface.
Geo. B. Riggins	\$8,100	Not given.
Coulter McKenzie Machine Co.	7,445	4,850 sq. ft.
Baker, Smith & Co.	6,889	Not given.
The Denny Bros. Co.	6,640	5,230 sq. ft.
Jacob Jamer	6,430	4,300 "
Rutzler & Blake	4,993	3,350 "

The contract was awarded to Messrs. Rutzler & Blake, they agreeing to do the work according to plans and specification, and guaranteeing to heat the buildings to 70° Fah. in zero weather.

TOPEKA, KAN.—At the last meeting of Council bids for constructing about 13 miles of sewers, varying from 9 inches to 66 inches, were opened as follows: Messrs. Alexander & Nelson, of Kansas City, bid \$157,953.64, omitting an item of \$500. Mullens & Decker, of Kansas City, bid \$159,431.48; this firm omitted two items worth about \$1,100. Messrs. Ryan & Carrigan, of Kansas City, bid \$162,300.32. C. J. Rosen's bid was \$170,549.70. These were not satisfactory bids and new proposals have been issued.

MILWAUKEE, WIS.—For furnishing a heating apparatus for the new Tenth Ward School, Milwaukee, H. Moers & Co., bid \$3,500; M. Coogan, \$3,240. The contract was awarded to Coogan.

DETROIT, MICH.—Bids opened for Belle Isle Bridge: Detroit Bridge and Iron Works, \$280,000; Mt. Vernon Bridge Co., \$287,000; Milwaukee Bridge and Iron Works, \$287,000.

NEW YORK CITY.—Bids were opened at the Department of Docks on August 5 for granite work and masonry on the boat-landing wall and about the approach to Pier A, North River. The following were the bidders: Bernard Mahon, New York City, \$1,775; Joseph Mone, New York City, \$0,000; John J. Connors, New York City, \$9,600.

BOSTON.—The Sewer Department on Saturday last received proposals for building the following sewers: Everett Street—Ward 25—1,096 lin. ft. of earth excavation and refilling above grade in trench for 2' x 3' 3" brick sewer; 600 lin. ft. ditto for 2' x 3' 3" brick sewer; 381 lin. ft. ditto for 2' x 4' x 3' 6"; 484 cubic yds. of brick masonry; 405 cubic yds. of concrete masonry; 166 pipe connections.

Braintree Street—Ward 25—625 lin. ft. of 15" pipe sewer; 775 lin. ft. of 12" pipe sewer; 7 manholes. Lincoln Street—Ward 25—460 lin. ft. of 18" pipe sewer; 215 lin. ft. of 15" pipe sewer; 605 lin. ft. of 12" pipe sewer; 6 manholes.

Jamaica Street—Ward 23—821 lin. ft. of 12" pipe sewer; 783 lin. ft. of 10" pipe sewer; 11 manholes. Minot Street—Ward 24—600 lin. ft. of earth excavation and refilling above grade in trench for 1' 8" x 2' 6" brick sewer; 600 lin. ft. of 18" pipe sewer; 200 lin. ft. of 15" pipe sewer; 600 lin. ft. of 12" pipe sewer; 103 cubic yds. brick masonry; 39 cubic yds. concrete masonry; 48 pipe connections.

Harvard and Mayland Streets—Ward 20—96 lin. ft. of earth excavation and refilling above grade in trench for 1' 1" x 2' 6" brick sewer; 400 ditto for 1' 8" x 2' 6" brick sewer; 118 lin. ft. of 15" pipe sewer; 330 lin. ft. of 12" pipe sewer; 84 cubic yds. brick masonry; 37 cubic yds. concrete masonry; 40 pipe connections.

Brooks Street—Ward 1—812 lin. ft. of earth excavation and refilling above grade in trench for 3' 4" x 6" brick sewer; 108 lin. ft. ditto for 20' x 30' brick sewer; 37 lin. ft. 15" pipe sewer; 101 lin. ft. 12" pipe sewer; 228 cubic yds. brick masonry; 332 cubic yds. concrete masonry; 64 pipe connections.

For Everett Street: Patrick Grace bid \$12,367.50 and Collins & Ham, who received the contract, \$10,599.05. Charles F. Latimer was awarded the contract for Braintree Street, his bid being \$1,048.62 to \$1,784 by Patrick Grace. Mr. Latimer was also awarded Lincoln Street for \$1,011.75; the other bidder being Patrick Grace, \$1,090. For Jamaica Street: Collins & Ham received the contract for \$2,060.60; the other bid was \$2,080.50 from Hugh Nann & Co. For Minot Street the bids were: Collins & Ham, \$3,273.50; H. Nann & Son, \$3,494.05; John Morley, \$2,492.50; Dennis O'Connor, \$3,710.30; John O'Connor, \$2,793.65; the contract was awarded to Mr. Morley. The bids for Harvard and Wayland Streets were: Collins & Ham, \$1,256.85; H. Nann & Son, \$1,524; John Morley, \$1,106.23; John O'Connor, \$1,367.87; Solomon Sanborn, \$1,936.50. Mr. Morley got the contract. The only bid for Brooks Street was that of Solomon Sanborn for \$9,283.80 and it was rejected.

NEW YORK CITY.—The following bids were opened at the Department of Public Works August 9:

Cast-iron water-pipe, branch pipe and special castings—350 tons straight pipe, 50 tons branch pipe and special castings.

Bidders—Camden Iron Company, straight pipe, per ton, \$34.45, branch pipe and special castings, per ton, \$59.50; McNeal Pipe Foundry and Machine Company, straight pipe, per ton, \$32.25, branch pipe and special castings, per ton, \$60; Mellert Foundry and Machine Company (limited), straight pipe, per ton, \$32.60, branch pipe and castings, per ton, \$55.

For furnishing material and labor in the erection of a brick storehouse and workshop at the foot of Twenty-fourth Street, East River:

Bidders—A. Hurns, \$8,000; James Mone, \$7,700; S. Smyth, \$7,180.

For a sewer in Madison Avenue, between Ninety-fourth Street and One Hundred and Third Street, and also in One Hundredth Street.

Specification calls for 2,270 lin. feet brick sewer, 350 lin. feet pipe, 2,000 cubic yards rock excavation, and 2,000 feet B. M. timber.

Bidders: B. Mahon, total, \$36,170; J. P. Kerrigan, \$27,730; J. McKim & Son, \$23,834.10; J. W. Slattery, \$29,279.60; J. McQuade, \$27,395.

Sewer in Fourth Avenue, east side, between Ninety-sixth and One Hundred and Second Streets.

Specification calls for 1,530 lin. feet sewer, 1,000 cubic yards rock excavation, 5,000 feet B. M. timber.

Bidders: J. W. Slattery, total, \$13,065; J. W. McQuade, \$14,585; I. W. Smith, \$13,897.50; P. Rielley, \$13,883.50; J. McKim & Son, \$13,789.

CINCINNATI.—Proposals for bridges (1) Mill Run between Terrace Park and Milford; (2) over Muddy Creek:

(1) Queen City Bridge Works, \$2,740; Lomas Forge and Bridge Works, \$2,800.

(2) Queen City Bridge Works, \$1,420; Lomas Forge and Bridge Works, \$1,395.

BOSTON.—The City Architect's Department received proposals, August 10, for furnishing all materials for mason work on an engine-house in Liverett Street. The bids were as follows: S. Brennan & Co., \$11,901; R. R. Mayers & Co., \$0,325; Kenning & Strout Bros., \$9,880; Abraham Ripley, \$9,980.75. The contract was awarded to Mayers & Co.

The City Architect's Department on Wednesday opened proposals for a tower around the stand-pipe erected for the high main supply at Mt. Bellevue in the West Roxbury District. The bids were: R. R. Mayers & Co., \$14,000; and Donahue Bros., \$14,250. Both bids were rejected as being in excess of the estimated cost, and new plans and specifications will be prepared.

For furnishing a foundation for the Horace Mann School House in the West Roxbury District: R. R. Mayers & Co. bid \$11,525; D. H. Cram, \$10,990, and Kenning & Strout Bros., \$11,843. The contract was awarded to Mr. Cram.

ST. PAUL.—The contract for the erection of the new building of the New York Life Insurance Company has been let to Hennessy Bros., Agnew & Cox of this city. There will be ten stories, basement and sub-basement. The total cost will be about \$1,000,000.

The Court-House Commission have opened bids as follows:

For carpenter work: W. E. Barber, \$125,712; A. Bassford, \$127,926; Henry Maltby, \$132,900; Paul Haupt, \$135,500; Johnson Bros. & Loomis, \$174,744; Bohn Manufacturing Co., \$126,614.78; J. W. Mankinson, \$132,000; Corlies, Chapman & Drake, \$134,000. For steam-heating work: Allen Black, \$23,000; Kinny Bros., \$7,174 for boilers only; William Rogers & Co., \$24,424; A. E. Neipel, \$37,000; Charles Parmlee, \$27,497; Thomas Davis, \$27,445.96.

The contract was awarded to the Bohn Manufacturing Company of St. Paul for carpenter work. Haugh, Ketcham & Company offered three bids on extra dormers—\$3,166, \$8,137, \$9,961. Mathias Breen offered one bid on dormers, same work, \$12,644.

NEW LONDON, CONN.—The following bids for furnishing and laying about 4,350 lineal feet of pipe-sewers were received by the Board of Sewer Commissioners August 4:

Shaw & Whittlesey, Providence, R. I.: 17-inch pipe-sewer, Washington Street, \$1.30 per foot; 8-inch pipe-sewer, Starr Street, \$1 per foot; 8-inch pipe-sewer, Green Street, 75 cents; 15-inch pipe-sewer, Court Street, \$1.05 per foot; 12-inch pipe-sewer, Court Street, \$1.15; 15-inch pipe-sewer, Court Street, \$1.05 per foot; 12-inch pipe-sewer, Hempstead Street, \$1.40 per foot; 10-inch pipe-sewer, Jay Street, \$1.12 per foot; 8-inch pipe-sewer, Huntington Street, 93 cents per foot; manholes \$4 per vertical foot. Contract awarded.

M. S. Austin, New Britain, Conn.: \$1.80, \$1.40, \$1.60, \$1.45, \$1.45, \$1.45, \$1.78, \$1.55, \$1.68, \$1.60, \$5 respectively.

Connahan & Chapman, Norwich, Conn.: \$1.25, 85c., 90c., \$1.30, 90c., \$1.32, \$1, 80c., 95c, 70c., \$3.75; informal, rejected.

Prices fixed by board: rock, \$4 per yard; sheeting, \$15; foundation, \$25 per M feet; concrete, \$5 per yard.

[TOO LATE FOR CLASSIFICATION.]

PROPOSALS.

BUILDING RESERVOIR.—Laying water-pipe and furnishing miscellaneous supplies for the city of Altoona, Pa. Until August 20. These include constructing the Kittanning reservoir, laying 25,600 feet of water-pipe, and 25,000 of trenching. Address the Board of Water Commissioners, Thomas H. Wiggins, Chairman.

PIPE SEWER, 15 inches. Until August 16. Address Thomas McKiernan, Chairman of the Sewers and Highway Committee, Altoona, Pa.

SEWER WORK.—Extending Beaver Creek sewer, Albany, N. Y. Until September 19. Two sureties, each in \$30,000. Address the Board of Contract, Thomas J. Lanahan, Clerk.

GARBAGE FURNACE.—Proposals will be received until August 19 for erection of a garbage furnace in such locality in the city of Allegheny, Pa., as may hereafter be designated by the Committee on Health, to destroy not less than twenty tons of garbage, night-soil or butchery offal every twenty-four hours. James Brown, Comptroller.

PAVING and curbing South Street, North Des Moines, Iowa. Until Address W. A. Garrett, Town Recorder.

GOVERNMENT WORK.

BOSTON, MASS.—In his report to the Secretary of War, Colonel George L. Gillespie recommends the following appropriations for improvements in Boston harbor:

Extension of sea wall, George's Island \$10,000
Extension of sea wall, Gallipoli's Island 7,500
Extension of sea wall, Long Island 3,000
Sea walls, south and east bluffs Gov.'s Island . . . 80,000
Widening main ship channel at upper middle . . . 250,000
Completing Fort Point channel 60,000
Widening and deepening Nix's Mate channel . . . 25,000

CHARLESTON, S. C.—Colonel Q. A. Gillmore, U. S. Engineer, has presented his report to the Secretary of War on the improvement of Charleston and Savannah harbors. For Charleston he asks \$750,000 for next year; \$10,000 for Wappoo Cut, S. C.; \$20,000 for Edisto River, S. C., and \$8,000 for Salkehatchie River, S. C. He asks for \$780,000 for next year's expenditure in Savannah harbor, and recommends that this entire sum be made available in one appropriation. If this be done, he says an annual expenditure of \$20,000 will be sufficient to maintain the works. Of the projected improvements of the Savannah River, between Augusta and Savannah, General Gillmore says the original estimate of \$91,000 will have to be increased to \$176,000. This is due to the meagre appropriations in the past. He is confident that if the project be now carried out a channel of five feet depth at low water will be secured. He estimates that \$4,633 can be profitably expended next year in Romyer Marsh, Geo.; \$30,000 on the Altamaha River, Geo.; \$75,000 on Brunswick Harbor, Geo., and \$600,000 on the entrance to Cumberland Sound, Fla. Captain W. M. Black, U. S. Engineer, submits the following estimates for expenditures during the next fiscal year: Upper St. John's River, Fla., \$10,000; Key West, Fla., \$30,000; Caloosahatchie River, Fla., \$13,000; Manatee River, Fla., \$15,000; Tampa Bay, Fla., \$73,000; Withlacoochee River, Fla., \$20,000; Cedar Keys, Fla., \$15,000; Suwannee River, Fla., \$20,000.

MINNESOTA WATERWAYS.—Major C. J. Allen, U. S. Engineers, in charge of work on the Upper Mississippi and on the Red River of the North, in his report recommends the expenditure of \$210,000 on rolling dams at the Falls of St. Anthony, \$25,000 for the Chippewa River, \$101,000 for Minnesota River, and other sums amounting, in all, to \$7,000,000.

SYNOPSIS of bids for iron columns, beams, etc., for Post-Office, etc., building at Minneapolis, Minn., opened at the Office of Supervising Architect Treasury Department, August 11:

Clark, Raffan & Co., of Chicago, Ill., \$6,680; time to complete, 90 days.

Dearborn Foundry Co., of Chicago, Ill., \$7,500; four to five weeks.

SYNOPSIS of bids for steam-heating and ventilating apparatus for the Court-House, etc., building at Lynchburg, Va., opened at the office of Supervising Architect, Treasury Department, August 12:

Crook, Horner & Co., of Baltimore, Md., \$3,911.22; time to complete, 45 days.

Bartlett, Hayward & Co., of Baltimore, Md., \$3,988; time to complete, 3 months.

Pierce, Butler & Pierce, of Syracuse, N. Y., \$4,087; time to complete, December 1, 1887.

L. E. Miller, of Salem, Mass., \$4,545; time to complete, 2½ months.

Edward L. Dent & Co., of Washington, D. C., \$5,132; time to complete, 8 weeks.

VICKSBURG, MISS.—Plans by Assistant Engineer Coffey have been approved by Captain W. T. Rossell, U. S. Engineers, for improving the Mississippi here. They provide for dykes and dredging.

ATLANTA, GEO.—The following bids for construction of public buildings, near Atlanta, Geo., were received by Captain J. W. Jacobs, Assistant Quartermaster, U. S. A., August 5:

John H. Mathews, Atlanta, Geo., officers' quarters, No. 6, \$15,398; officers' quarters, No. 7, \$15,398; officers' quarters, No. 8, \$15,398; officers' quarters, No. 9, \$15,398; storehouse, \$5,258; oil-house, \$567; N. C. O. quarters, No. 34, \$5,113; stable, \$5,154; corral, \$1,984; total, \$84,781.

D. M. Compton, Atlanta, Geo., \$21,544, \$21,544, \$21,544, \$21,544, \$8,005, \$1,102, \$7,038, \$7,038, \$12,846; total, \$130,209; no bid on corral.

Atlanta Construction Co., Atlanta, Geo., \$18,400, \$18,400, \$18,400, \$5,666, \$595, \$6,840, \$6,840, \$9,845; total, \$101,387; no bid on corral.

William McConnell, Atlanta, Geo., No. 6, \$21,905; storehouse, \$5,352; oil-house, \$810; N. C. O. quarters, \$7,644; stable, \$5,669; corral, \$2,401.

Broomhead & Street, Atlanta, Geo., \$20,551, \$20,551, \$20,551, \$20,551, \$5,377, \$685, \$5,825, \$5,825, \$9,346; total, \$109,266; no bid on corral.

Harris & Co., Newport, Ky., \$15,080, \$15,080, \$15,080, \$15,080, \$5,000, \$1,000, \$9,500, \$9,500, \$5,100, \$2,700; total, \$84,039; bid on all.

WASHINGTON, D. C.—Bids for constructing three steel cruisers of about 4,500 tons displacement each and two steel gunboats of about 1,700 tons each were opened by the Secretary of the Navy, August 8. On Cruiser No. 1, Cramp & Son, the only bidder, bid \$1,248,000. For Cruisers Nos. 4 and 5 and Gunboats Nos. 3 and 4 proposals were divided into three classes: Class 1, both hull and machinery to be in accordance with the plans of the Department; class 2, both hull and machinery to be in accordance with the contractor's own plans, guaranteed to give the requisite results; class 3, hull to be according to Navy Department plans, with machinery according to the contractor's plans. The proposal of Cramp & Son, of Philadelphia, for Cruiser No. 1 is of class 3, or according to the mixed plans.

For Cruisers Nos. 4 and 5 Cramp & Son proposes to build hull and machinery both according to the Department's plans for \$1,410,000 each. The bid for the same cruisers built according to their own design throughout is \$1,335,000 each, and built according to the mixed plans \$1,405,000 each.

The only other bidder for the cruisers was the Union Iron Works of San Francisco. They bid only for the cruisers' hull and machinery, in accordance with the plans of the Department. Their bid was \$1,428,000.

In the bids for Gunboats 3 and 4 F. Palmer, Jr. & Co., the firm with which Mr. Quintard, John Roach's assignee, is connected, bid \$490,000 each. According to the Department's designs entirely Cramp & Son proposes to build the gunboats at \$495,000 each.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 12. } PUBLISHED EVERY SATURDAY.

NEW YORK, AUGUST 20, 1887.

LONDON, SEPTEMBER 3, 1887.

SINGLE COPIES, TEN CENTS. } IN AMERICA
Subscription, \$4.00 per year in advance, post paid. }
SINGLE COPIES, SIXPENCE. } IN GREAT
Subscription, 20s. per annum in advance, post paid. } BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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A PLAN TO PROVIDE CHICAGO WITH SUB-CELLARS AND TRIFLE WITH THE SEWERAGE PROBLEM.

WHENEVER a knotty problem in public works is to be solved a number of amateurs almost invariably appear on the scene and gratuitously offer solutions and valuable (?) technical advice with a confidence and an assurance often far exceeding that of experts with long experience. Sewerage works in particular seem to be a favorite subject for such self-constituted authorities and have produced a new variety of *homo sapiens* commonly known as the "sewer crank." He has made himself conspicuous in almost every European country and has been frequently met with in our own. One of his latest effusions comes from Chicago. Oblivious of the fact that from Mr. E. S. Chesbrough to the present Drainage and Water-Supply Commission, professional engineers have been wrestling with the problem of that city, there appears a Mr. Gordon Nott who, in a lecture before the Grant Club, presumes to solve the difficulties in "a very simple manner."

As is usual with such men, he ignores past history and experience, "as there is but little there that will aid us in dealing with the question of sewage-disposal of Chicago," and evolves the solution from his inner consciousness.

Our readers are generally familiar with the fact that Chicago is situated on a nearly level plain lying a few feet above Lake Michigan and about seventy-five above the Desplaines River, a small affluent of the Mississippi River, about thirty miles west of the city. It has been the dream of Chicagoans for many years to cut a channel from Lake Michigan to this river, principally to establish a large navigable waterway between Chicago and the Mississippi, and incidentally to dispose of the city's sewage in an effective way. Mr. Rudolph Hering, Chief Engineer of the present Drainage Commission, has reported this to be the most economical solution of the problem, and in every respect the best one, provided a sufficient quantity of lake-water is sent with the sewage to thoroughly dilute it and to deprive it of its offense-giving qualities. The cost of the project has been estimated at about \$25,000,000.

Mr. Gordon Nott, however, believes that less than \$10,000,000 will solve the problem. He proposes in the first place to abolish the present sewers and construct a new separate system for the whole city lying some twenty or thirty feet below the present one. This, he believes, will give "an entire new basement and, in some cases, a sub-basement to the future great city," which is the keynote to his great scheme. He gives no estimate of cost for this new system of deep sewers, believing that the advantage of obtaining these basements would more than pay for it on every street, (!) forgetting that the blue clay underlying the city makes deep drainage practically unnecessary for this purpose and that basements have already been built wherever desired.

Mr. Nott then proposes to carry the sewage from this low level by means of a tunnel 30 miles long through rock to the Desplaines River, for which he estimates a cost of \$9,161,000. Before discharging the sewage, however, its sludge is to be precipitated with lime in basins covering 350 acres. For these and for the precipitation itself no estimate of cost is given, but the threadbare story is again told that the profits from the sale

of the sludge will fully pay the expense, whereas a half-million dollars annually would hardly pay the cost of purifying the Chicago sewage of today, while the sludge would be practically worthless.

But Mr. Nott's genius has not exhausted itself here. In some mysterious way, the sewage while still in the sewer is to be partly purified by agitation. The fall into the low-level sewers is to be put to use at numerous points in developing a power for compressing air to operate the "agitators." He has evidently heard something about purifying water by aeration and plunged with this idea into his sewer. If he had the remotest conception of the mechanical and chemical processes necessary to accomplish what he proposes, he would at least have left his agitators out of the scheme.

However, all communities having important municipal problems to solve are afflicted with the suggestions of the self-constituted adviser and the crank. We have had them in this city in the consideration of our new water-supply problem, Milwaukee is now apparently likewise afflicted, and Chicago cannot expect to be exempt.

To their credit, though, it may be said, they furnish padding material to the daily newspaper editor in a dull time, and occasional amusement to the engineer who has time to read their effusions.

HOW TO DRESS IN HOT WEATHER.

THE *Epoch* of August 5 contains three papers on "How to Keep Cool and Well in Summer," by Drs. Cyrus Edson and Willard Parker, and Mr. David Jardine, which are in the main full of sensible advice. But Dr. Edson says it is best to wear dark clothing in summer, because black radiates heat more freely than white, and says that animals living in the Arctic regions are white, because that color holds the bodily heat. Dr. Parker, on the other hand, gives the usual opinion that light-colored clothing is best in hot weather. Dr. Parker is right and Dr. Edson is wrong.

The experiments of Coulier ("Expériences sur les étoffes qui servent à confectionner les vêtements Militaires, Jour. de la Physiologie, 1858,") show that the difference of absorption and radiation between different colors of the same stuff are not perceptible in the shade at temperatures between 70° and 100° Fah., while the white is much less absorbent than the black when exposed to the rays of the sun.

Dr. Edson's theory of the cause of the white color of animals in the Arctic regions, which we suppose he would extend to explain why the black races are found in the tropics, is one that is not in the least tenable.

The great point to be kept in view in selecting clothing for hot weather is, not so much to provide for the hottest part of the day as for the evening when the temperature falls, and when cotton gauze underclothing is likely to lead to chilling the surface and to lay the foundation for rheumatic neuralgias of various kinds.

Thin woolen underclothing and light colored cotton stuffs for outer wear during the middle of the day are the best. The clothing should be loose to allow free circulation of air and evaporation from the skin. Tights are hot, though they may look cool on the stage.

THE fifteenth annual report of the Local Government Board of England, with its appended documents, is not inferior in interest and importance to any of the preceding volumes of the exceedingly valuable series of which it forms a part. Dr. Buchanan explains that the work of the department during 1885 was largely concerned with cholera, and that, having made a special report on this subject, the present volume is devoted to other matters.

Of these the newest and most important is the connection of scarlatina with disease in milch cows, the investigations of Mr. Power and of Dr. Klein with regard to which have been already noticed in THE SANITARY ENGINEER AND CONSTRUCTION RECORD. Some additional data are given in the present report, among which is an important statement by Dr. Klein that he has obtained from the blood of ordinary human scarlatina a micro-organism apparently identical with that found in the ulcers on the udders of the cows from whose milk Mr. Power proved that scarlet fever had been spread. This peculiar disease of the cow, which appears to be due to the same cause as scarlatina, and to be capable of producing the disease in man, is not one which makes the animal very ill, and it may easily be overlooked.

Scarlatina is pre-eminently a disease of England and Wales, in which it causes from 17,000 to 18,000 deaths annually on the average, and the consequences of this discovery are likely to be of great practical importance in a preventive point of view.

Another important advance in knowledge is the discovery by Dr. Klein of the specific micrococcus, which is the cause of what is known as the foot-and-mouth disease, or contagious apthæ of cattle, and especially of the fact that it is probably possible to successfully vaccinate animals against this disease. The experiments reported in previous volumes as to the efficacy of various disinfectants have been continued, with the result that the perchloride of mercury (corrosive sublimate) has greater antiseptic and disinfecting powers than any other known substance, but that the species, pedigree, and stage of growth of various micro-organisms differ widely as to the power of resisting the poisonous action of this salt. Fortunately, those micro-organisms which are the most dangerous are the easiest to kill.

Another interesting result obtained is that ozone seems more antagonistic to the ordinary bacteria of putrefaction than to the bacteria which cause specific disease.

Dr. H. F. Parsons furnishes a report on the manufacture of rag flock in reference to the possible dissemination of infectious disease by this and other products of woolen rags, in which he describes the various processes employed in such manufactures, and states as the result of his inquiries of medical officers of health in the rag-working districts and of flock manufacturers, rag merchants, and upholsterers, "that while workpeople engaged in the manufacture of flock suffer from certain symptoms produced by the irritation of inhaled dust, instances in which infectious disease had been contracted by them were scarcely to be met with." He also thinks that "workers among woolen, or partly woolen, rags are exposed to less danger of infection than workers among calico rags. The disease most likely to be propagated by rags is small-pox, and against this vaccination of the workpeople is the most certain preventive measure.

In the process of paper-making the rags are thoroughly and effectually disinfected, so that the product is not a source of danger to the community, but in making flock such disinfection is not obtained, and there is, therefore, more reason for asking that all such rags be disinfected.

It will be seen from this brief and incomplete sketch of the contents of this volume that it is one which every sanitarian must procure and study.

THE City Council of Atlanta has passed an ordinance which provides that the Board of Health can investigate any suspected well, and if the water is found impure can so declare; and that after the well shall have been declared impure any one who shall use water from it for drinking or in making food shall be summoned to appear in police court for trial. The object is excellent, but it seems to us that it would have been better to have stated what would be considered impure water, and then to forbid such use absolutely. Under the terms of the ordinance the water from a polluted well may be used for washing purposes, and if a child takes a drink of water drawn for such purposes it is the child that is to be prosecuted instead of the person who drew the water. It would be well, also, to state distinctly what the penalty is for violating this ordinance.

LEPROSY IN LOUISIANA.

THE New Orleans *Times-Democrat* of July 22 contains a pathetic letter from one of the unfortunate persons in Louisiana who are afflicted with leprosy, pointing out that such persons can get no work, that they cannot be admitted to a general hospital nor isolated in private houses, and appealing for some provision for them; and upon this makes some sensible and timely editorial comments. There are at least thirty known lepers in the State, besides others whose systems are affected with the disease, and in whom it will probably show itself sooner or later. The great majority of these cases are due to heredity, and the danger of acquiring the disease by direct contagion is extremely small, yet it does exist, and should be guarded against in time. Says the *Times-Democrat*:

"To allow a leper to remain at large, mixing with other people, intermarrying with healthy families, and sending his children to the public schools, is to tamper dangerously with the public health. We have allowed this disease to smolder away in Louisiana too long. It can be extinguished to-day with very little trouble and at very little expense by the establishment of a leper hospital or asylum; and this would at the same time be a blessing to these unhappy people, who now, in their last days, have to hide away from view on account of the popular repulsion to them, and who receive none of the medical treatment they so much need to mitigate their suffering. Cannot the Legislature give the State a leper hospital? It ought not to cost over \$3,000 or \$4,000 a year at most—probably half as much—and it will in ten years extinguish leprosy in Louisiana forever. Will not private charity do something for these people?"

The case is one which requires both State aid and private charity, and it is to be hoped that both will be provided.

FIRE-BRICK PAVEMENTS FOR ROADWAYS.

A REPORT has been made public to the effect that a specimen piece of fire-brick pavement put down in 1885 on Pearl Street, Cincinnati, has failed utterly. The description given states merely that the foundation was sand, well rolled, but says nothing as to the thickness of the brickwork. It has never been claimed by the advocates of brick pavements that it was suitable for very heavy traffic; and it is possible the mistake has been made in this case of subjecting it to a traffic for which it is not fitted. A thin pavement on a sand foundation would be in such case pretty sure to fail.

It may also be that the bricks were not of the right sort, as they need to be hard-burned and vitrified throughout. Such bricks are reported to have stood a crushing strain of over 8,000 pounds per square inch, approaching in this respect the lower grades of granite. It would be manifestly unfair to condemn the use of brick altogether in consequence of an indefinite report such as this is. We are inclined to believe that, under right conditions, there is a wide field to be usefully occupied by well-made brick pavements.

OUR BRITISH CORRESPONDENCE.

Intimate Terms between Mr. John Thompson and his Employees—German Regulations calling for a Pictorial Device in Trade-Marks Abolished—Sheffield Water-Works Company—East London Water-Works—The Carpenters' Company.

LONDON, July 27, 1887.

THE remarks made at a Jubilee fete, when Mr. John Thompson, the builder of Peterborough, entertained his workmen a fortnight since, show the amount of "touch" between that successful builder and his employees. They further show that a good master is appreciated by his workmen. Mr. Thompson stated that amongst those present was a man who had been working in the firm close upon sixty years, and had never worked for any other; that there were others present who had worked between forty and fifty years, and a larger number also, twenty to thirty years. He stated that a few weeks since he received a letter from his workmen expressing their sympathy with him, that notwithstanding the fact that he was finding them employment, business was not so good as it had been for a long time. The men, therefore, volunteered to second him in any effort he might make to obtain contracts at a reduced cost, and offered to make personal sacrifices to that end. It is not often that one finds such intimate terms between employer and employed, but when they do present themselves, it is pleasurable to record them as highly creditable to both sides.

Patentees and manufacturers should note that the German regulations calling for a pictorial device in the trade-mark has been abolished.

A few weeks since I gave particulars of the arrangement made between the Sheffield Water-Works Company and the Corporation, whereby the latter will take over the water-works for the good of the town. It would appear as though there was friction between the two parties, for I hear a report that the water company has served the Board of Guardians with a notice that they will cut off the supply from the workhouse, containing 1,400 paupers, unless a claim for six years' rent of hydrant is met. Under the present peculiar condition of the law, the guardians are prohibited from paying any such claims at a later date than three months after due, and, without obtaining the Local Government Board's sanction, they plead they are unable to pay, and request the company to wait till such time as permission can be obtained. The company, however, decline to wait, and it remains to be seen whether they will enforce their claim under this anomalous state of the law.

The East London Water-Works, who were a few months since providing their customers with eels in their water-supply, are again to the fore. The supply is intermittent, and for some time past it appears that the unfortunate people dependent upon this company have had to go on very short commons. A few days since, however, no water was supplied throughout the whole district of West Ham for twenty hours. This, coming after the regular deficient supply, has been a matter of annoyance as well as danger, owing to the long spell of hot weather. Some of the customers state that for weeks past they have had insufficient water from 8 o'clock at night till 9 the next morning, even for such purposes as flushing out closets. It will be a bad thing for water companies, as proprietary concerns, if complaints of this kind continually present themselves, as the question of the Government taking over the business will then, of course, again present itself.

The Carpenters' Company has instituted an examination for efficiency in theoretical and practical acquaintance with the craft, and members who pass this examination will have a certificate awarded to them. The first examination takes place in June next.

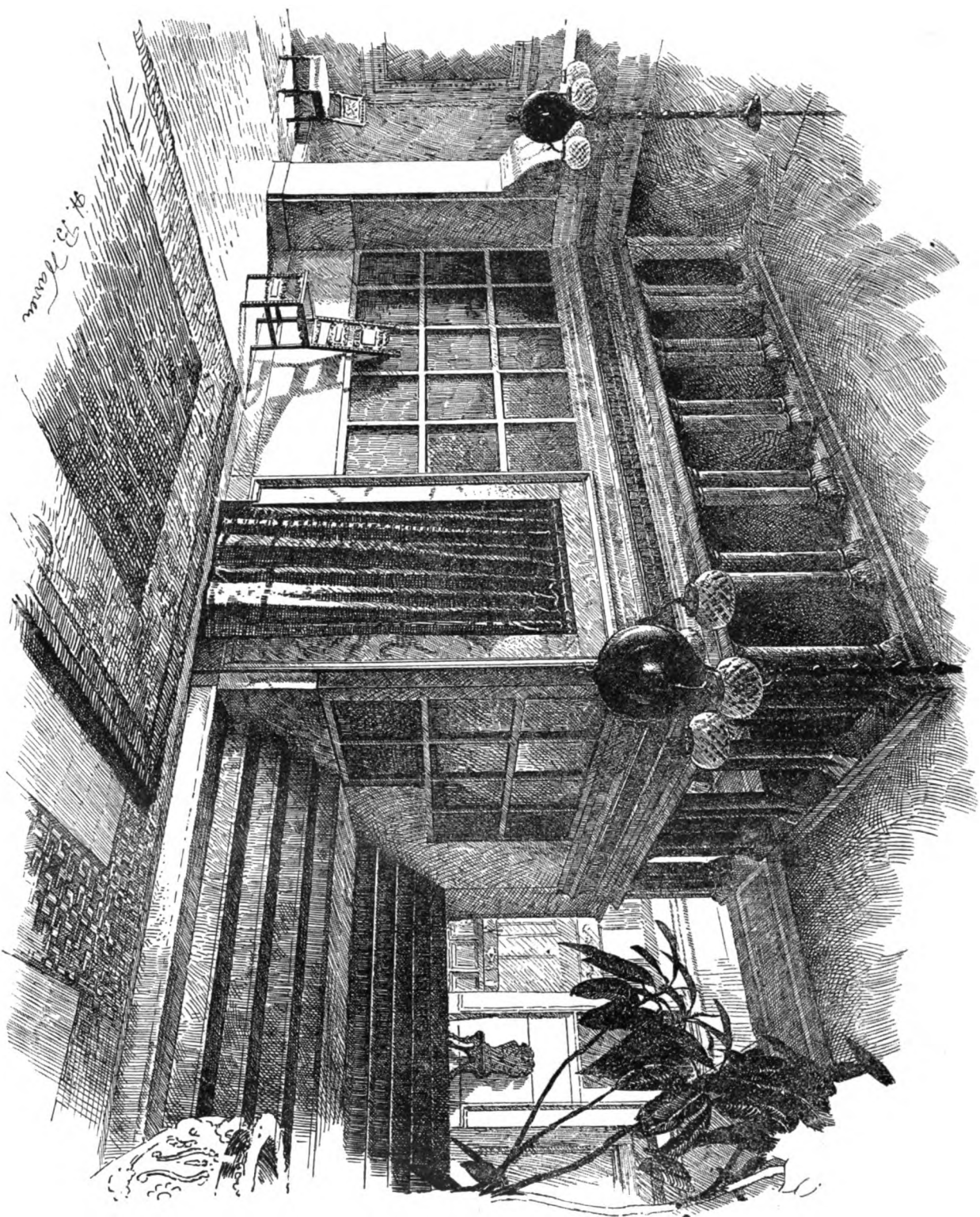
SAFETY-VALVE.

OUR SPECIAL ILLUSTRATION.

OUR special illustration this week shows a hall in the Tiffany House, New York City. Messrs. McKim, Mead & White, architects.

OUR DETAIL SHEET.

WE give this week a sheet of details showing sketches from the Chase House, Annapolis, Md., a pilaster and two elliptical arches from Fells Point, Baltimore, Md.



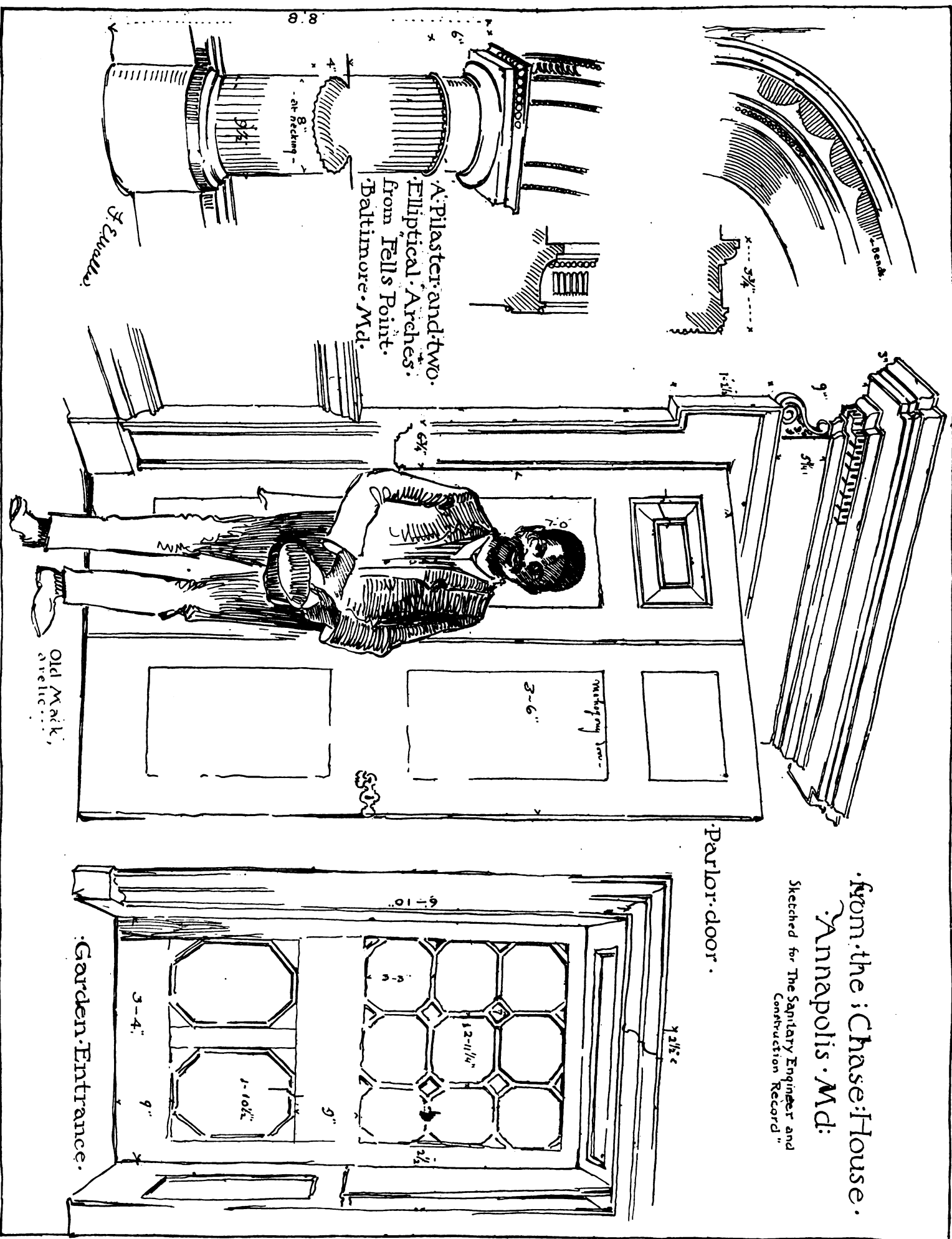
THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HALL IN TIFFANY HOUSE, NEW YORK.

MCKIM, MEAD & WHITE, ARCHITECTS.

NEW YORK, VOLUME XVI.

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from the Chase House.
Annapolis, Md.
Sketched for The Sanitary Engineer and
Construction Record

RECENT SEWER CONSTRUCTION.

No. VII.

(Continued from page 630, Vol. XV.)

CHISWICK SEWAGE-WORKS.

[Prepared for THE SANITARY ENGINEER AND CONSTRUCTION
RECORD by Joseph Hetherington, Resident Engineer.]

In recent inquiries and discussions about the disposal of town's sewage, the outfall-works of Chiswick main drainage have been frequently referred to, the advocates of precipitation processes using them as illustrations of the efficacy of chemical treatment of sewage; the opponents holding them up as proofs of failure to clarify sewage by such processes. The works, interesting in themselves, are additionally so because of the complete records of the work done, the quantities of sewage, sludge, cost, etc., instituted by the late surveyor of Chiswick, Mr. G. R. Strachan, and kept up to date. It is proposed in

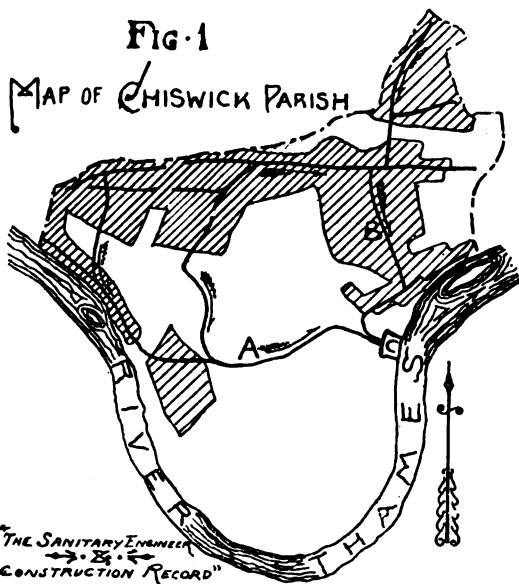
Chiswick sewage-works were built in response to a demand from the Thames Conservancy for the sewage to be taken out of the river, the demand being backed up by power to exact a penalty of £100 a day till it was complied with. London was specially exempted from this penalty, and it continues to pour a small river of sewage into the Thames. Chiswick, being the first parish outside the privileged boundary, immediately received attention at the hands of the Conservancy Board, and it would appear to have been more amenable to pressure than contiguous parishes, for in nine years from the passing of the act (in 1867), the town had adopted the scheme of Mr. H. O. Smith, and in three years more had got its works built, its main sewers laid, and commenced treating its sewage, while pollution, both directly by drains, and indirectly by cesspools, still goes on all around it. A high standard of purity of affluent is insisted on, and the works that have been built are closely watched at the same time, that the penalties, where there are no works, have grown to such enormous amounts that the Conservators have to look helplessly on at the pollution they were empowered to prevent. This state of things is an illustration of the futility of legislation when the entire body of inhabitants resists its enactments, for the enforcement of the penalties would bankrupt the population, if a magistrate could be found who would impose them.

as possible, and up to 1883 only about half the roof-area drained into the sewers, the water from the other half being disposed of in cesspools. At the time the works were designed it was assumed that the water-supply was about thirty gallons per head, and the population being then 10,000, a dry-weather flow of 300,000 gallons was expected. An equal allowance was made for rain, and two pumps were put down each capable of lifting 1,200,000 gallons in twelve hours, which was the flow expected in a rainstorm when the population had doubled (double the population now resides in Chiswick): but so quick does the roof-water arrive in a heavy rainstorm that both pumps together can hardly keep pace with it. This is partly owing to the whole roof-area of houses built since 1883 being drained into the sewers, and in part to a portion of road-water admitted recently. The bulk of road-water, however, is disposed of in cesspits under the crown of the roads, whence it rapidly soaks away into the gravel and sand. No provision was allowed for subsoil and river leakage, and to these causes a great difference between the calculated and actual flows is due. The effects of rainstorms, of tidal leakage, and subsoil leakage will be illustrated further on by diagrams.

Figure 1 is a sketch map of Chiswick parish, the shaded areas roughly representing the built-up parts of the parish. It contains an area of 1,300 acres, once nearly all laid out

Fig. 1

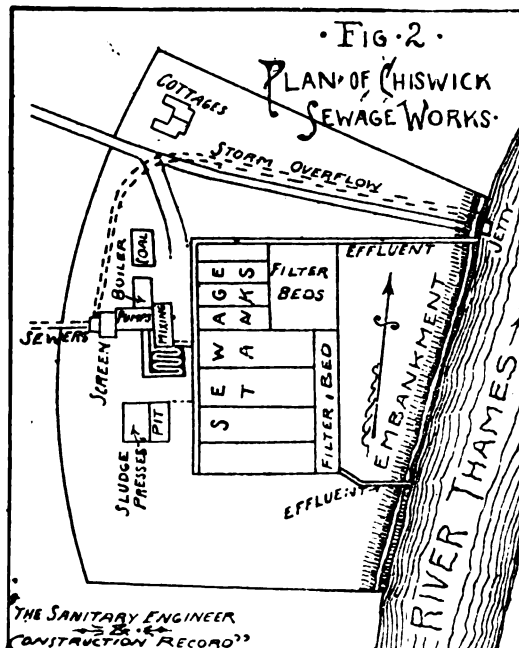
MAP OF CHISWICK PARISH



the following paper to give a somewhat detailed description of the works as they now are, with diagrams showing the effects of rain, tide, and leakage on sewage flow, and accurate and reliable particulars of the quantity of sewage and sludge per head of population, etc. It may have occurred to some that descriptions of large and complicated works, instead of being given before the works have been tested, would be of greater value if written after the works had been in operation. Such advantages as knowl-

• FIG. 2 •

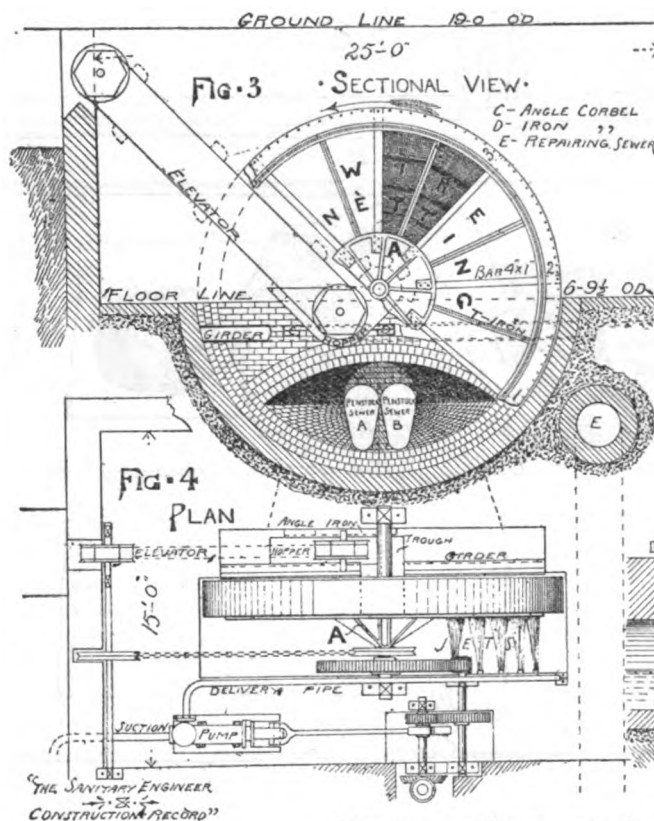
PLAN OF CHISWICK SEWAGE WORKS.



edge of the practical working of the place described can confer, this paper will possess, and mistakes that have been found out will be mentioned that others may avoid them.

Fig. 3

• SECTIONAL VIEW •

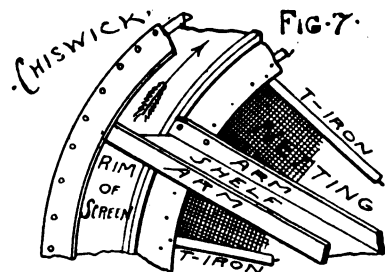


• DETAILS OF REVOLVING SCREEN • CHISWICK •

When the Conservators had been satisfied by the removal of the solids from its sewage, Chiswick found fresh trouble with the sludge. A neighboring proprietor haled the Local Board into the Court of Chancery for polluting the air, and under pressure again filter-presses and other improvements were added, bringing the works up to date in all essential particulars.

FIG. 7.

DETAIL OF REVOLVING SCREEN



Prior to this scheme, the drainage of the houses near the river—being that of the greater part of the town at that time—was discharged directly into the river, and the houses inland disposed of their drainage by cesspools. As the parish is extremely flat and lies low, all the sewage has to be pumped to command the tides. The sewers have a gradient of 1 in 1,000, and are principally pipe-sewers laid in many places below the level of the subsoil water. An effort was made to exclude as much rain-water

as market gardens ; its ratable value about £105,000, and its population has grown from 8,500 in 1871 to 20,000 in 1886, and is still rapidly increasing. There are two main intercepting sewers, marked A and B in Fig. 1, which convey the collected sewage to the pumping-station, marked C, where it is pumped, treated with chemicals, and then discharged into the river.

The pumping-station and outfall-works are on one site of $5\frac{1}{2}$ acres of land on the shores of the Thames (see Fig. 2). The sewers enter the works on the left, their invert at this point being at datum line. The sewage passes through a screen on its way to the pump-wells. Here it is raised nineteen feet, and delivered into a winding channel, where the chemicals are added and mixed. The winding channel conducts it to a distributing channel on the left of the tanks; sluice-doors in this channel communicate with each of the right tanks, and any one may be filled at pleasure. After settling in the tanks, the affluent is drawn off by floating arms and discharged into the river, and the sludge swept down to the pressing-house and dealt with by filter-presses. The land on which the works are built lies low, and was under water at all high tides. An embankment has, therefore, been run along the river side, and the remainder of the boundary is by a thick concrete wall. The ground-line inside the area has been raised from twelve feet O. D. to nineteen feet O. D., which makes it $1\frac{1}{2}$ feet higher than the highest recorded tide. The works are about 350 yards from Chiswick House, owned by the Duke of Devonshire, and tenanted by the

Marquis of Bute. A considerable number of good houses are quite as near.

Before sludge-pressing was introduced the sewage received no better screening than could be given by a grating of iron bars—each bar an inch square, and each space an inch wide. Such a screen necessarily was most inefficient, and to remedy this Mr. Strachan put in a Baldwin Latham's patent revolving screen, illustrated at Figs. 3, 4, 5, 6, and 7. This is essentially a huge bricklayer's sieve made of iron, and made to revolve in a vertical plane at right angles to the sewer, with its open side toward the town. The sieve is divided into eight compartments by shelves fixed to the arms and in planes parallel to the axis. The wheel is carried on a 6-inch shaft through a heavy boss A. This boss is extended to the front by brackets (figured in Figs. 3 and 5), so arranged as to leave an annular space round the shaft, and from the front side of the boss, as well as from the back, arms of 4x1-inch iron are extended to the rim. The spaces between the front and back arms are closed by shelves of sheet-iron $\frac{3}{8}$ -inch thick, shown in Fig. 5 and enlarged in Fig. 6. The spaces in the back are subdivided by light T-irons to carry the wire netting, made up in sixteen sections and bolted by hook-bolts to the arms and T-irons. The wire used is No. 12 and 14 B. W. G., galvanized and woven so as to give a mesh $\frac{1}{4}$ -inch square. Motion is given by a small vertical engine in the engine-room above, and transmitted by a vertical shaft through gearing to the screen, which is revolved at the rate of about one and one-half revolutions per minute. The sewage is spread into the screen by a bell-mouth, into which the two intercepting sewers discharge, and as it passes through the screen on its way to the pump-wells, all solids that will not pass through a hole one-quarter of an inch square are stopped. The paper and such like matters cling to the netting, and when the section they are in reaches the position indicated between 1 and 2, Fig. 3, jets of water from a force-pump are played over the netting, causing the clinging matters to drop on to the shelf.

Corks, brushes, and such like solids float toward the rim at first, where they are kept till the shelf they are on rises to 2 in Fig. 3. They then begin to go with the rush of water along the shelf in the direction of the centre, passing through openings between the brackets and dropping into a trough of semi-circular section which is placed in the annular opening at the centre. The trough figured in Figs. 4 and 5 is closed at one end, and opens at the other into a hopper which carries it. A worm on the shaft pushes the solids along the trough, whence they drop into the hopper. An elevator carries them from there up into a truck placed below ground. An enlarged section of the rim is shown at Fig. 6, and an India-rubber lip which keeps the space between the screen and brick-work closed. As it is difficult to renew this lip at Chiswick, it is proposed to fix wood on the face of the rim and trim it up true and close to the brick-work.

(TO BE CONTINUED.)

FRUHLING'S SELF-ACTING FLUSHING-APPARATUS.*

THE sewers of Königsberg were of such a description as to require frequent flushing, and as the use of the town water-supply at stated intervals would have been too costly, the Municipal Engineer, Mr. A. Fruhling, has devised this apparatus, which has proved most successful. Many thousands of these flushing-chambers have been in operation since they were first used in May, 1883. The construction of the apparatus is explained by reference to two diagrams. The exit-pipe, at the bottom of the flushing chamber, is closed by a valve, which valve is raised by the action of a balanced float. When the chamber is empty the valve sinks on to its seating, and closes the outlet pipe, and the ordinary flow of sewage-water gradually fills the chamber until the level is reached at which the hollow float would rise but for the retardation due to a subsidiary float, shaped like a scoop, which is attached to the principal float by a jointed lever-arm, actuated by a rolling weight confined in a cylinder, so as to alter the centre of gravity when lifted to the required level by the inflow of water. As soon as the water has filled the chamber, the valve is raised, and the counter-balance tilts and empties itself while the water is rushing into the sewer, keeping up the valve which closes the exit until the chamber is nearly empty, when the float again sinks and closes the outlet as before.

* From *Gesundheits Ingenieur*, 1887, page 23, and printed in the proceedings of the Institution of Civil Engineers.

CONVENTIONAL SPECIFICATIONS.

IN speaking of the stereotyped form of clauses and the conventional manner of making them into a specification of the whole, or of copying the same old form of specification over and over again, with a few alterations as to dimensions, the *Building News* says:

Specification-writing, like legal draftsmanship, has rather obscured than made clear the duties of those who are entrusted to carry out the intention of the author. In both of these forms of professional prescriptions, the verbiage is by no means any gauge of the comprehensiveness or clearness of the draftsman; sometimes, indeed, the greater the verbosity the more doubtful is the meaning conveyed. Nor is curtness of phrase always a sign of clearness and intelligibility. It often is a substitute for knowledge and precision. Such a clause as "All the materials to be of the best quality and approved by the architect" conveys very little information. The word may mean "best" of a certain kind; it may imply best of the kind generally used by the architect, not necessarily the best quality that can be procured or best for its application. These adjectives, however, embody in any easy uncompromising sort of way what is nevertheless to be inferred, without committing the writer to any statement that would expose his ignorance of materials. It is not at all unlikely that some of the vague clauses found in specifications are derived from the descriptive agreements of tradesmen who have supplied materials and workmanship, and who were careful not to bind themselves to any exacting terms. Definite prescription requires an extensive knowledge of materials, trade-marks, and the methods of workmanship, a degree of attainment that can only be expected from knowledge and practical experience. A young architect would, for example, be safer to describe the stone to be used "to be of the best quality, free from all vents, shakes, and other imperfections," than if he were to describe a particular quarry without knowing the different beds and qualities, which would tie him to the acceptance of perhaps an inferior stone. So with regard to timber. The customary clause is that the timber is to be from the Baltic, or "to be of the best Dantzic, Riga, or Memel yellow fir," though there are few architects who obtain the best from either of these ports. A more experienced architect who knew something of the timber trade would be contented if he could be sure of getting medium quality Memel or Dantzic, from some well known shipper. A favorite clause is that "no Swedish timber is to be used," though it is worth notice that "mixed" quality Swedish red or yellow deals are often better than so-called first quality Baltic. The specification phrase—"the best timber"—means, in the timber merchant's vernacular, straight-grained timber, free from knots. Probably there is more room for evading the intention of the architect in this part of the specification than in any other; so many characteristics go to make up good timber—the mode of growth, time of felling, and nature of the soil. * * *

To avoid stereotyped phraseology, the result of copying one specification from another, the profession may do something. At present the tendency is to repeat a good general form *ad infinitum*. Specialization is avoided as being inconvenient, and local peculiarities of material and workmanship are not favored by the writer. On the contrary, the clauses are dictated by a knowledge of the materials of a very general and often imperfect nature. It is the information that has been picked up in the office during apprenticeship; acquired not from contact with quarrymen, brickmakers, timber importers, and workmen engaged in building, but more from office traditions. Once a general form has been adopted, it is transmitted to future generations. A special form for each new building would be exceedingly laborious and inconvenient, and to some extent certainly unnecessary. But clauses are repeated so often that they lose their original significance and force. Contractors get to look contemptuously upon an official jargon that they know has been applied to hundreds of very dissimilar cases. We may give a few illustrations. The conventional specification reads: "The mortar is to be compounded of stone lime and sharp, clean sand, mixed together in the proportion of one of lime to two of sand." The contractor takes little notice of the formula. The proportion is not attended to, there is no test specified, and the lime may be anything but fresh. Then, "sharp, clean sand"—how often we find sea-sand instead of clean pit sand. The clause has been interpreted in such a manner as to disarm criticism; the germs of mischief appear on the wall, but nothing can be done to rectify the mistake.

Again, as to the concrete or Portland cement, the ordinary clause is based on imperfect data. High tensile strength is generally made a condition, whereas the more practical test is the adhesive strength. It is well understood that the tensile test depends on several circumstances—the atmosphere, the mode of manipulation, temperature of water, etc., and may therefore be very misleading. Air slaking is a very important condition, but seldom insisted upon. The cement may be over-limed, which gives a high result at seven days, but is found to lead to expansion and cracking of the concrete mass. A tensile strength of 350 pounds per square inch at seven days increasing with the age is preferable. Mr. Mann suggests the following specification for adhesive strength: "The Portland cement shall be ground so that no more than 45 per cent. shall be stopped by a No. 176 silk sieve, and its adhesive strength after 28 days' immersion shall be 95 pounds per square inch; cement, as supplied for use, not less than 75 pounds per square inch. Six tests being employed in each case." The No. 176 silk sieve gives 30,976 meshes per square inch.

Another stereotyped clause prescribes the drains; so many feet of stoneware pipes of a certain diameter are specified, and the mode of jointing; little is said about the bottoms of trenches, nothing about ramming them, about gradients, about avoiding curves and sudden drops, the cleaning out of the pipes as they are laid, and other precautionary measures, such as testing. We have no space to go through all the trades and suggest improvements and point out omissions. What we complain of are the uncertainties and inexact descriptions of many matters which are left to the good sense and knowledge and honesty of the contractor. A great deal is left to the founder and engineer. The iron joists that are provided are often of Belgian manufacture, and need careful specification and testing. Details like bolts and nuts and threads are left to the maker. To pass to general ironmongery, the same generalities suffice. Contractors repeatedly fix door-locks of very inferior description because the specification is inexplicit about the kind of lock intended. The hot-water supply is one of the many special provisions that are left to the contractor or engineer owing to the imperfect or superficial knowledge of the writer. General directions can only be given, but these should be more intelligible than the phrase, "To provide and fix to the architect's satisfaction a hot-water apparatus, etc., etc." At least the position of the pipes, the kind of boiler, tank, or cylinder ought to be specified. The circulation-pipes should be directed to be placed in positions that will avoid the inconveniences of contact with the soil or waste pipes. There are a score of other technicalities which ought to be mastered before a competent or sufficient specification of a heating system is written.

Reference is made to the stereotyped phrases used in other trades but the above is ample to show that in England the same objections exist and the same questionable want of knowledge of details are to be found in specifications that we so often find here among the incompetent young men who "hang out their shingles" after being a year or two in an architect's office, and get work from impecunious builders and owners because they are satisfied to work for nothing, or next to nothing, while they are "making a name."

THE HARBOR OF MONTREAL.

A PLAN has been proposed by Mr. F. J. Gilman for building an embankment nearly a mile long, from the abutment of Victoria Bridge down to Bonsecour Market; this bank to be about 300 feet wide, and considerably higher than the highest flood ever known. By means of a division embankment, an upper harbor will be thus enclosed 4,000 feet long, 2,000 feet wide, and 27 feet deep, opening into Lachine, and also a lower harbor opening into the river, which will be about 1,900 feet by 3,000 feet. It is claimed that no damage will be caused to the waterway, but that by stopping the collection of ice and snow on the shallow area covered, there would be an equally free passage to all floods. Room will be afforded on the embankment for two lines of railroad forming junctions with the Grand Trunk and Canada-Pacific lines. The cost is estimated at two and a half million dollars.

THE Committee on Publication of Franklin Institute of Philadelphia has in contemplation the publication of an index of the authors and subject-matter contained in the first 110 volumes of the *Journal of Franklin Institute*, from 1826 to 1880, provided a sufficient number of subscriptions is obtained to cover the cost of the project. The subscription price has been placed provisionally at \$5. H. L. Heyl is the actuary.

PAVEMENTS AND STREET RAILROADS.

No. XI.

(Continued from page 293.)

SINCE wood and asphalt pavements have been extensively adopted in the best paved thoroughfares of London and Paris, and since the American experience with wood pavements has been unsatisfactory because of the improper methods adopted in laying them, and lack of care after being laid, we have thought it well to reprint in this series the paper by George Henry Stayton Assoc. M. Inst. C. E., with an abstract of the discussion thereon, which was had before the Institution in 1884.

Though the paper deals with wood pavements, for which the author apparently has a preference, yet with the discussion and criticism it elicited it is a valuable contribution on this subject, which our American readers will, we believe, appreciate.

Following this paper we propose to give the recent experience and present practice in several of the important parishes of London and in the city of Paris, the data and information having been secured during a recent visit to those cities.

WOOD PAVEMENT IN THE METROPOLIS.*

The necessity for stimulating the efforts of those persons who are actively engaged in the construction and maintenance of street carriageway pavements in the metropolis and large cities was strenuously urged during the discussions at the Institution in 1879, when the subject was brought forward by Mr. Deacon and by Mr. Howarth. The object of this paper is to call attention to the various wood-pavement works recently executed in the metropolis, and to a comparison of the results obtained thereby. Although the paper may not contain much that is new, the author ventures to think that the general interest evinced in works which tend to the efficient and economical maintenance of the carriageways of important thoroughfares, and the direct bearing which such works have upon the comfort and convenience of a community, may be sufficient to justify a review of the progress in this system of pavement.

It may not be uninteresting to consider for one moment the extent of the streets of the metropolis, and the nature of the materials of which the carriageways thereof are formed; and the author desires to tender his warmest acknowledgments to the president, who in his official capacity as the Chief Engineer to the Metropolitan Board of Works furnished him with valuable data, and to Mr. W. Haywood, M. Inst. C. E., the city engineer, and to forty-three chief surveyors of parishes and districts of the metropolis, for their courtesy in replying to his communications thereon. The information thus obtained has enabled him to present it in the tabulated form which will be found in Table I. in the appendix, according to which it appears that at the commencement of the present year the aggregate length of the streets of London amounted to 1,966 miles. Of that length, however, 248 miles are at present "new" streets, inasmuch as they have not been adopted by a local authority; consequently there are 1,718 miles of public streets under the maintenance of the various authorities, the carriageways of which consist of the following materials—viz.:

	Miles.
Macadam	573
Granite	280
Wood	53
Asphalt	13½
Flints or gravel	798½
Total	1,718

The extent of the vehicular traffic is equally remarkable, the result of inquiries instituted by the author showing that in the metropolis alone, at the present time, there are approximately 100,000 horses and 40,000 vehicles, the licensed cabs numbering 10,381, and omnibuses, etc., 2,223, and the estimated value of the horses, harness, and vehicles amounts to no less than £5,000,000 sterling. Obviously the ordinary wear and tear of these vehicles must in a great measure depend upon the condition of the street carriageways.

No doubt many members of the institution have a vivid recollection of the extremely unsatisfactory state of those macadamized carriageways in leading West-end thoroughfares, which have given place to wood pavement. It was rarely the case that such roadways were in a good state of repair; on a hot summer day they invariably emitted disagreeable smells and frequently gave off a great amount of dust; and it is scarcely possible to conceive anything more deplorable than the state of such streets whenever the surface became greasy or sloppy after rain. All things considered, there was not only undoubted cause for dissatisfaction, but ample justification in the outcry against the former state of things; as, what with damage to horses, harness, vehicles, and pedestrians' clothing, together with the sheer waste of money in laying down broken granite to be ground into mud, an alteration was most necessary.

The efficient condition of street carriageways is essentially a ratepayers' question, and the unprecedented adop-

tion of wood as a paving material in substitutions of macadam, proves that several of the metropolitan vestries and other authorities have taken a new departure, and apparently a step in the right direction. In expressing this opinion it will be readily understood that the author in no way desires to pass over the respective merits of granite, asphalt, or bituminous-concrete pavements, and of roadways formed with broken granite, flints, or gravel, as they are undoubtedly suitable for certain localities, and in many cases are economical as compared with wood. While therefore it is asserted that a properly constructed wood pavement possesses the advantages of noiselessness, surface elasticity, safety, and cleanliness, and is pre-eminently suitable and economical for business and residential thoroughfares having a high traffic standard, it should not be forgotten that in the case of narrow business streets leading out of main thoroughfares, wood pavement might be unsuitable, as by reason of the unimportance of the vehicular traffic, the blocks would probably decay internally long before they were worn out by the traffic. For such reasons, and from a sanitary point of view, it would appear that asphalt would not only be preferable, but also eminently suitable.

Large sums of money were expended during the early years of wood pavement revival, in the acquisition of patent rights of doubtful value, in experimenting thereon, and in foolish contracts. These stages have been surmounted, and the result is that street paving in the West-end has been almost revolutionized within a few years. Wood pavement has been termed a "West-end luxury," and in one sense the assertion is perhaps justifiable, inasmuch as not more than 4.38 per cent. of the wood pavement in London is east of the city, or south of the Thames.

EXTENT AND CONSTRUCTION.

The superficial area of wood pavement laid in London

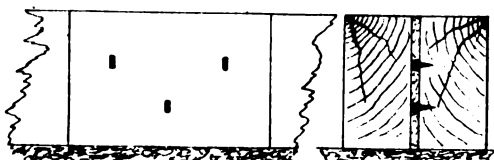
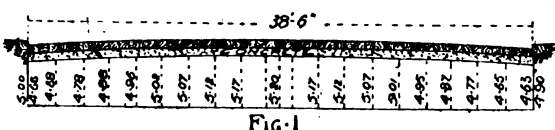


FIG. 3. MODE OF JOINTING

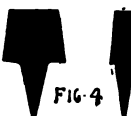


FIG. 4. FORM OF STUD

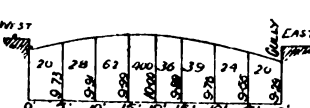


FIG. 5

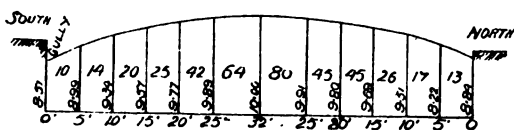


FIG. 6

during the last ten years has been 980,533 square yards, its length 53¼ miles, and the cost of its construction, together with subsidiary works, has probably involved an outlay of £600,000. It is now possible to drive through wood-paved main thoroughfares for a distance of several miles; (c. g.) wood pavement is practically continuous from London Bridge, the exception being the eastern part of the Strand, to any of the stations between Chelsea and Uxbridge Road on the West London Railway.

Obviously, much valuable experience and data have thus been gained as to the best mode of construction and maintenance, and as the author ventures to think that a paper on wood pavement would be incomplete unless it embraced every detail, however simple, he will endeavor to discuss the various points which arise, with a view to ascertaining whether wood has practically realized the expectation that it would prove to be a safe, convenient, and economical material for street carriageway pavements.

The suitability of "wood as a paving material under heavy traffic" was so fully treated by Mr. Howarth in 1879, that the author thinks it unnecessary to refer in detail to questions which have reference to the proper growth of wood, the cause and effect of wear and tear, and the method adopted for recording the traffic; the object being to describe at length the various points of construction which have hitherto been only partially considered, together with particulars of recent modifications.

Excavation.—The suggestion has been made that macadamized carriageways might be broken up expeditiously with the aid of explosive mixtures, but the author would hesitate to try it; as, however slight the concussion and vibration might be, there is little doubt that gas and water mains and services, especially those which have been in existence for a considerable period, would be injured. Practically there is little variation in the method adopted, the main object being to get the work done as quickly as possible. In preparing for the construction of the wood-pavement works in Chelsea, the method of opera-

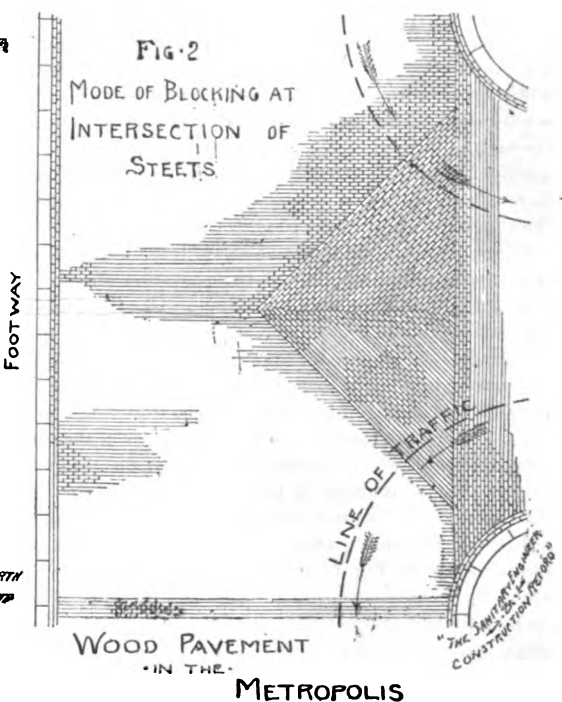
tion consisted in breaking up the macadamized carriageways by driving steel wedges into and through the consolidated layer of broken granite, commonly called mac, at intervals of a few feet. The surface or crust being thus "started," its removal was effected by prizing it upwards in lumps of a square yard or more with stout hand-levers, 6 to 8 feet long, after which it was easily disintegrated. As a rule, a depth of 9 inches of macadam was thus removed prior to the excavation of some 5 or 6 inches of foundation.

In those instances where the carriageway had previously been paved with granite upon a concrete foundation, as in Oxford Street, it was found unnecessary to disturb the concrete, since by adding about 2 inches thereto, and floating the surface, a satisfactory foundation was obtained, and considerable expenditure avoided.

Levels and Contour.—When the width of a street is irregular, and the levels of the footways on either side vary considerably, it is sometimes not a little complex to satisfactorily determine the question of level and contour; but when the longitudinal inclination is naturally slight and uniform, the width parallel, and the footways nearly correspond in level, as in Sloane Street, a very simple rule may be observed.

The practice of the author has been to first determine the level of the crown or vortex of the carriageway to be paved, and next to set out the levels of the channels, by allowing a rise to the crown equivalent to 1 inch in 3 feet (⅓) above the mean channel level. By slightly flattening the crown, Fig. 1, it will be observed that a contour is obtained which not only renders traffic easy, but is of pleasing appearance, and satisfactory in other points.

Whenever practicable, the longitudinal inclinations of the channels should not exceed 1 in 150, and it is desirable that the minimum depth of kerb exposed at the summit of a channel should be 2½ inches, with a maximum depth of 6½ inches at a gully. By the observance of this rule it



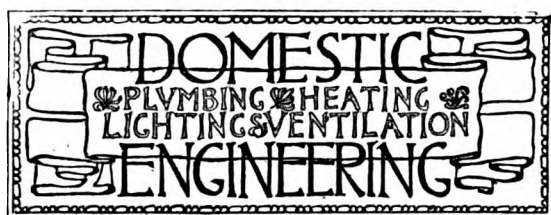
necessarily follows, that in a tolerably level street the provision of street-gulleys becomes an important item, but the extra cost, about 4 per cent., which their construction entails, is amply repaid, not only by the convenient and uniform appearance of the carriageway, but in the prompt and effectual removal of rain-water from the surface of the pavement. The author submits that this is an element of success in the construction of wood pavement which, unfortunately, is too often overlooked.

The longitudinal crown-level should be uniformly sustained from street to street whenever practicable, so as to prevent undulations; and it is likewise important that the crown should be extended transversely at all intersections, partly for the sake of appearance, but mainly to obviate the unpleasant effect which is caused by driving over a channel. The neglect of this rule is very apparent upon observing the effect of vehicular traffic over the crossings to Rutland Gate and Princes Gate on the south side of the Kensington High Road.

Foundation.—It is satisfactory to note that foundations consisting of single or double planks placed upon a bed of sand have been completely discarded, and that the fallacies of the so-called elastic foundation have given place to a more permanent system. It was only necessary, shortly after a fall of rain, to witness the effect of a vehicle being rapidly driven over a pavement which had been laid on the former system for a period of two or three years, to have ocular demonstration of its utter unworthiness. The series of little fountains of dirty water which have spouted up in the wheel tracks from the open joints would soon have dispelled the hopes of the most ardent believer in the theory; and the result not only made it inconvenient for pedestrians, but very soon caused the pavement to go to pieces.

Although lias-lime concrete has been used as a foundation, it may safely be asserted that 90 per cent. of the existing wood pavement is laid upon Portland cement concrete. The latter, properly prepared, is absolutely im-

*A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. VIII.

(Continued from page 213.)

FRICTION IN LONG PIPES.

In long pipes the friction of the water against the insides of the pipes must be considered. The insides of the pipes are then often called the "rubbing sides" or surfaces. In short smooth pipes under small head or pressures, the loss by friction is not very great when compared to the whole flow, but in long pipes passing large quantities of water it is considerable as it increases in a ratio (about) directly as the increase of length of the pipes and as the square of the velocity of the water through the pipes.

The loss to the flow by friction in pipes of four inches and upwards, under pressures and velocities such as is used in cast-iron water-mains, is well established and known to hydraulic engineers, many eminent mathematicians having considered the subject and formulated rules which some of our more recent investigators have verified or corrected, and which, in the hands of some of our hydraulic engineers, give results surprisingly accurate.

For small tubes, however, under very small heads of water, and such as can be found in heating apparatus, there is no very authentic data. Prony's formulæ is considered by Thomas Box as probably the most correct for small pressures and small diameter pipes, but perhaps as much or more dependence can be put in the tables of G. A. Ellis, C. E., of Boston, than in anything else extant on the subject, as they are largely made up from observations by himself and other hydraulic engineers in the United States.

TABLE No. III.

Friction loss in inches of water-head for each 10 feet length of different size clean iron pipes; discharging given quantities of water per minute:

U. S. Gallons Passed Per Minute.	Size of pipe—inside diameter.														
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	14"
1	1.6	1.4	1.1	0.93	0.81	0.64	0.51	0.41	0.32	0.25	0.19	0.14	0.10	0.08	0.06
2	3.6	3.1	2.4	2.0	1.8	1.4	1.1	0.9	0.7	0.55	0.42	0.31	0.22	0.17	0.13
3	5.4	4.7	3.6	3.0	2.7	2.1	1.6	1.3	1.0	0.8	0.6	0.45	0.33	0.25	0.19
4	7.2	6.3	4.8	4.0	3.6	2.8	2.1	1.7	1.3	1.0	0.75	0.55	0.4	0.3	0.22
5	9.0	7.9	6.0	5.0	4.5	3.5	2.6	2.1	1.6	1.2	0.9	0.65	0.48	0.35	0.26
6	10.8	9.5	7.2	6.0	5.4	4.2	3.2	2.6	2.0	1.5	1.1	0.8	0.58	0.42	0.31
7	12.6	11.1	8.4	7.0	6.3	4.8	3.6	2.9	2.2	1.6	1.2	0.9	0.65	0.48	0.35
8	14.4	12.7	9.6	8.0	7.2	5.4	4.0	3.2	2.4	1.8	1.3	1.0	0.75	0.55	0.4
9	16.2	14.3	10.8	9.0	8.1	6.0	4.5	3.6	2.7	2.0	1.5	1.1	0.8	0.58	0.42
10	18.0	15.9	12.0	10.0	9.0	6.6	4.9	3.9	2.9	2.2	1.6	1.2	0.9	0.65	0.48
11	19.8	17.5	13.2	11.0	10.0	7.2	5.3	4.2	3.1	2.4	1.8	1.3	1.0	0.75	0.55
12	21.6	19.1	14.4	12.0	10.8	7.8	5.7	4.5	3.3	2.6	1.9	1.4	1.1	0.8	0.58
13	23.4	20.7	15.6	13.0	11.7	8.4	6.1	4.8	3.5	2.8	2.1	1.5	1.2	0.9	0.65
14	25.2	22.3	16.8	14.0	12.6	9.0	6.6	5.1	3.8	3.0	2.2	1.6	1.3	1.0	0.75
15	27.0	23.9	18.0	15.0	13.5	9.6	7.1	5.4	4.0	3.2	2.4	1.8	1.4	1.1	0.8
16	28.8	25.5	19.2	16.0	14.4	10.2	7.6	5.8	4.2	3.4	2.6	2.0	1.5	1.2	0.9
17	30.6	27.1	20.4	17.0	15.3	10.8	8.1	6.3	4.5	3.6	2.8	2.1	1.6	1.3	1.0
18	32.4	28.7	21.6	18.0	16.2	11.4	8.6	6.6	4.8	3.8	3.0	2.2	1.7	1.4	1.1
19	34.2	30.3	22.8	19.0	17.1	12.0	9.1	7.0	5.1	4.0	3.2	2.4	1.8	1.4	1.1
20	36.0	31.9	24.0	20.0	18.0	12.6	9.6	7.5	5.4	4.2	3.4	2.6	2.0	1.5	1.2
21	37.8	33.5	25.2	21.0	19.0	13.2	10.1	8.0	5.7	4.4	3.6	2.8	2.2	1.6	1.3
22	39.6	35.1	26.4	22.0	20.0	13.8	10.6	8.5	6.0	4.6	3.8	3.0	2.4	1.8	1.4
23	41.4	36.7	27.6	23.0	21.0	14.4	11.1	9.0	6.3	4.8	4.0	3.2	2.6	2.0	1.5
24	43.2	38.3	28.8	24.0	22.0	15.0	11.6	9.5	6.6	5.0	4.2	3.4	2.8	2.2	1.6
25	45.0	39.9	30.0	25.0	23.0	15.6	12.1	10.0	6.9	5.2	4.4	3.6	3.0	2.4	1.8
26	46.8	41.5	31.2	26.0	24.0	16.2	12.6	10.5	7.2	5.4	4.6	3.8	3.2	2.6	2.0
27	48.6	43.1	32.4	27.0	25.0	16.8	13.1	11.0	7.5	5.6	4.8	4.0	3.4	2.8	2.2
28	50.4	44.7	33.6	28.0	26.0	17.4	13.6	11.5	7.8	5.8	5.0	4.2	3.6	3.0	2.4
29	52.2	46.3	34.8	29.0	27.0	18.0	14.1	12.0	8.1	6.0	5.2	4.4	3.8	3.2	2.6
30	54.0	47.9	36.0	30.0	28.0	18.6	14.6	12.5	8.4	6.2	5.4	4.6	4.0	3.4	2.8
31	55.8	49.5	37.2	31.0	29.0	19.2	15.1	13.0	8.7	6.4	5.6	4.8	4.2	3.6	3.0
32	57.6	51.1	38.4	32.0	30.0	19.8	15.6	13.5	9.0	6.6	5.8	5.0	4.4	3.8	3.2
33	59.4	52.7	39.6	33.0	31.0	20.4	16.1	14.0	9.3	6.8	6.0	5.2	4.6	4.0	3.4
34	61.2	54.3	40.8	34.0	32.0	21.0	16.6	14.5	9.6	7.0	6.2	5.4	4.8	4.2	3.6
35	63.0	55.9	42.0	35.0	33.0	21.6	17.1	15.0	9.9	7.2	6.4	5.6	5.0	4.4	3.8
36	64.8	57.5	43.2	36.0	34.0	22.2	17.6	15.5	10.2	7.4	6.6	5.8	5.2	4.6	4.0
37	66.6	59.1	44.4	37.0	35.0	22.8	18.1	16.0	10.5	7.6	6.8	6.0	5.4	4.8	4.2
38	68.4	60.7	45.6	38.0	36.0	23.4	18.6	16.5	10.8	7.8	7.0	6.2	5.6	5.0	4.4
39	70.2	62.3	46.8	39.0	37.0	24.0	19.1	17.0	11.1	8.0	7.2	6.4	5.8	5.2	4.6
40	72.0	63.9	48.0	40.0	38.0	24.6	19.6	17.5	11.4	8.2	7.4	6.6	6.0	5.4	4.8
41	73.8	65.5	49.2	41.0	39.0	25.2	20.1	18.0	11.7	8.4	7.6	6.8	6.2	5.6	5.0
42	75.6	67.1	50.4	42.0	40.0	25.8	20.6	18.5	12.0	8.6	7.8	7.0	6.4	5.8	5.2
43	77.4	68.7	51.6	43.0	41.0	26.4	21.1	19.0	12.3	8.8	8.0	7.2	6.6	6.0	5.4
44	79.2	70.3	52.8	44.0	42.0	27.0	21.6	19.5	12.6	9.0	8.2	7.4	6.8	6.2	5.6
45	81.0	71.9	54.0	45.0	43.0	27.6	22.1	20.0	12.9	9.2	8.4	7.6	7.0	6.4	5.8
46	82.8	73.5	55.2	46.0	44.0	28.2	22.6	20.5	13.2	9.4	8.6	7.8	7.2	6.6	6.0
47	84.6	75.1	56.4	47.0	45.0	28.8	23.1	21.0	13.5	9.6	8.8	8.0	7.4	6.8	6.2
48	86.4	76.7	57.6	48.0	46.0	29.4	23.6	21.5	13.8	9.8	9.0	8.2	7.6	7.0	6.4
49	88.2	78.3	58.8	49.0	47.0	30.0	24.1	22.0	14.1	10.0	9.2	8.4	7.8	7.2	6.6
50	90.0	79.9	60.0	50.0	48.0	30.6	24.6	22.5	14.4	10.2	9.4	8.6	8.0	7.4	6.8

He has constructed a table for friction in small diameter pipes of various sizes from existing tables reduced to

pounds pressures for U. S. gallons and 100 feet length of pipe. With his kind permission I have reduced and interpolated such parts of his table (No. 5 in his book), as I think would be likely to be of use to a hot-water engineer, to pressures represented by inches of water-head instead of pounds and for a length of 10 feet instead of 100 feet as in his table.

This table is No. III., and shows the friction loss in inches of water-head consumed in the straight pipes of an apparatus for each ten feet length of pipe, for the different number of U. S. gallons given in the first column.

For instance, should the difference of temperature between the flow and return pipe of any part of an apparatus appear to warrant a flow of 10 U. S. gallons of water per minute in a 2-inch pipe, .324 inch of the head will be consumed in each ten feet of the pipe in giving motion to the water and it will be lost as power. If the pipe is twenty feet long twice as much of the total head—or .648 of an inch—will be consumed by friction, as in the case just cited, but if five feet of pipe is used half only of the .324 inch of water-head will be consumed, or .162 of an inch.

The loss of head by friction in very short pipes compared to the loss of head by entry is small, but as the pipes become longer the friction loss increases about as the length of the pipe, whereas the loss by entry remains the same, so that a point is soon reached where the loss by friction is greater than the loss by entry. This point may be roughly placed at between 50 and 60 diameters of the straight tube.

Let it be borne in mind, therefore, that in a short tube the loss of head by entry may be a large percentage of the whole, but that in a long tube it may become comparatively small, and the loss by friction alone become great enough to use up nearly the whole head at our disposal.

With our subject, however, the loss by friction will be generally comparatively small, with small velocities and large diameters, as an inspection of the Table No. III. will show, but it also shows how rapidly it increases as we attempt to use small diameter pipes and try to get a given quantity of water through them by an increase of pressure.

Our table, therefore, may be likened to a table of resistances, and it can be used to determine approximately the comparative size of flow-pipes for an apparatus in which the resistance is to be nearly alike. For instance, it will be noticed that when one gallon of water passes through 10 feet of one-inch pipe in a minute the resistance is about $\frac{1}{10}$ of an inch of water-head, and that nearly 2 gallons will pass through the same length of $1\frac{1}{4}$ -inch pipe with the same resistance, 3 gallons through one $1\frac{1}{2}$ -inch pipe, 5 gallons through a 2-inch, 30 gallons through a 4-inch, 500 gallons through a 10-inch, and so on through the table; all giving a resistance of only $\frac{1}{10}$ of an inch of water.

It stands to reason, therefore, that if the 10-inch pipe will pass 500 gallons with so small a loss of head that 100 two-inch pipes may flow into it, each passing 5 gallons, and the resistance in all will be alike; or they may all take supply from it as they would in the flow pipe of an apparatus. Of course, if the pipes are all doubled in length, the resistance is doubled also, but what I wish to call attention to in the table is, that lines of equal resistance may be traced approximately through it for pipes of about the same length, though for different diameters, and that hereafter on proportioning the size of pipes for apparatus, this fact will be made use of.

(TO BE CONTINUED.)

REGISTRATION OF PLUMBERS IN LONDON.

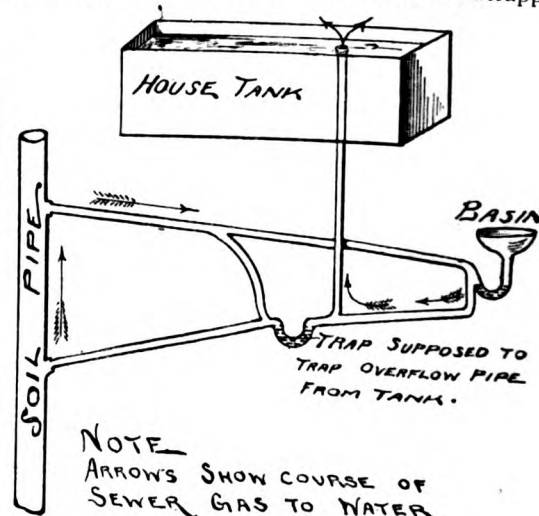
OUR London correspondent writes: "Very great dissatisfaction indeed is being expressed on all hands in connection with the registered plumbers' movement, on the ground that the qualifications of a great many registered plumbers do not justify their admission. Consequently good men are no better off than they were before, the only difference being that they have to pay an annual subscription to the company, as registered plumbers, which, of course, they did not formerly have to do. The Plumbers' Company will certainly have to make an alteration in the matter, otherwise a very large number of good men, both journeymen and masters, will decline to figure as R. P.'s (Registered Plumbers), leaving the company in the proud position of having none but 'duffers' as contributors. So far as the public are concerned at the present time, they do not seem to have troubled themselves at all as to whether they are employing a plumber or a 'botch.'"

SOME VIOLATIONS OF THE PLUMBING REGULATIONS AND TENEMENT-HOUSE LAWS LATELY DISCOVERED BY THE INSPECTORS OF THE BOARD OF HEALTH OF NEW YORK CITY.

THE accompanying sketch shows a faulty arrangement of traps, wastes, and vent-pipes which form a "by-pass" for sewer-gas, recently discovered by an inspector of plumbing in each of ten houses in East Eighty-first Street, near Fifth Avenue, in New York City. It presumably was caused by ignorance and perhaps want of experience on the part of the plumber, and as he has been notified to make the work good by the Department of Health, and will probably do so, we refrain at the present time from mentioning his name.

The matter goes, however, to show that caution and a knowledge of what is to be guarded against is as vital or more so in any kind of construction as knowledge of the conventional methods of doing work.

In this case the sewer-air passed from the basin trapped into the untrapped overflows of the cisterns, escaping into the upper parts of the houses. Nor does it at first glance appear that the cistern or house-tank is untrapped,



and it is very evident that the designer, in his eagerness to place a trap between the overflow and the sewer that would not be evaporated, caused the whole trouble. He probably thought that the water from the basin flowing through the running trap would always keep it sealed, which undoubtedly it would, but he overlooked the fact that the basin trap-vent made a "by-pass."

Richard Disbrow, builder, was arrested on July 21 and brought before Justice Murray for refusing to alter defective house-sewers when notified by the Board of Health. These houses we have reported before and the plumber was arrested then for skin plumbing, but in the case of the house-sewer or work outside the front wall the owner has now been arrested, as this was not the plumber's work. The liability of the owner is recognized in all cases, but in those where he is supposed not to be aware of actual facts, the plumber who does the bad work is the one first proceeded against.

(TO BE CONTINUED.)

Novelties.

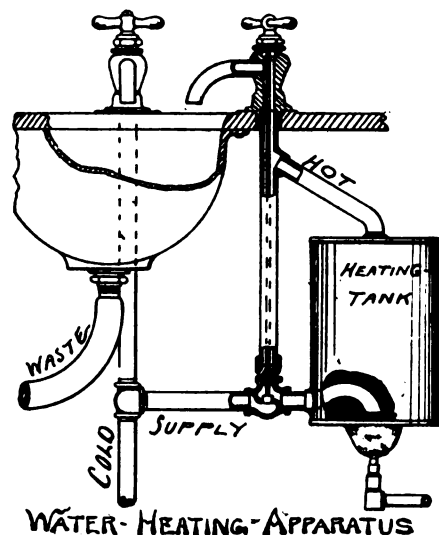
Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

APPARATUS FOR WARMING WATER AT THE WASH-BOWL.

THE accompanying drawing illustrates a novel attachment for wash-bowl for warming water in limited quantities where no regular hot-water system is in use, and is the invention of Joseph Love, of Chicago, Ill.

It consists of a small closed tank or boiler of any suitable shape placed underneath the basin-slab. A branch from the cold-water supply to the basin is taken through the side, low down, or bottom of the tank and a special valve is used in it in such manner as to come under the position ordinarily occupied by the hot-water faucet of the basin. The stem of this valve passes tightly through a nut and tube and is carried above the slab, so as to simulate in all particulars the hot-water faucet with handle,

bibb, etc. A pipe from the top of the tank joins the upright tube below the slab about as shown or in any manner suitable. A suitable gas-burner for heat is placed underneath the tank and the apparatus is ready for use. Its action is as follows: When once water is let into the tank it remains full afterward. When hot-water is required the burner is lighted until the water in the tank is sufficiently



warm. Then the faucet-handle is turned, which apparently opens the faucet on the slab, but in reality opens the valve in the supply-pipe to the tank. The cold water runs in and diffuses itself over the bottom by being fed down through the gooseneck and displaces the warm water by forcing it through the top pipe into the bowl through the bibb on the slab.

Should steam form by the boiling of the water it will escape through the bibb, as it always remains open. The products of combustion from the gas-burner can be passed off through a local vent by having the tank in a case or lantern.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
August 13.....	21.58	20.60	22.00	28.64	24.48	21.70	29.59

E. G. LOVE, Ph.D., *Gas Examiner.*

THE *Gas Engineer* gives the following facts regarding the petroleum industry of this country: "Oil wells, numbering 53,000, have been drilled in Pennsylvania and New York since the discovery of petroleum, at a cost of \$200,000,000. These wells have produced 310,000,000 barrels of oil, which was sold at the wells for \$500,000,000. This represented a profit to the producer of \$300,000,000. The amount of oil exported is placed at 6,231,102,923 gallons. Independent of the oil business, there are about \$50,000,000 invested in natural-gas plants in Pennsylvania.

WE understand that the Coal Tax Bill and the Electric-Lighting Bill are not to be considered during the present session of Parliament.

MR. E. P. THOMPSON has found that the blackening of the glass of the incandescent lamps is chiefly due to the carbon particles which are driven off on first closing the circuit when the filament obtains a static charge. In order to avoid this Mr. Thompson has made lamps in which the filament surrounds a loop or stem of copper wire, which passes through the stem of the lamp and is connected to earth; the wire being also provided with several points which project towards the filament. The result is that when the static charge is received the carbon molecules tend to be projected upon the wire, and the blackening of the glass is prevented. Mr. Thompson's

theoretical explanation of the effect is certainly sufficiently plausible to merit consideration, but it appears to us that if this view were correct it would follow that incandescent lamps supplied with alternating currents should blacken much more rapidly than with continuous currents, and their life should be much shorter. We have not learnt that such a result has ever been observed, and it would almost appear that this objection is fatal to the static charge theory.—*The Electrician.*

COOKING by gas has greatly augmented the revenue of the Glasgow corporation. The consumption of gas in June has shown an increase of 800,000 cubic feet compared with June, 1886. This is due to the new department of the corporation in letting out stoves on hire. This experience should induce companies in large towns to go and do likewise.—*Gas Engineer.*

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

BOOKS ON VILLAGE IMPROVEMENT SOCIETIES.

CHERRY VALLEY, N. Y., August 5, 1887.

SIR: Will you kindly give me a list of the books most needed in organizing a "Village Improvement Society" in a small place where there is not much money nor enthusiasm, and consequently the more need for the society, and oblige, yours respectfully, MRS. A. M. DAKIN.

[Mr. B. G. Northrop, at one time connected with the Connecticut Board of Education, has written on this subject. We must refer our correspondent, however, to our readers for more explicit information.]

THE CONSTRUCTION OF CESSPOOLS FOR COUNTRY HOUSES.

SALEM, August 8, 1887.

SIR: I have a small house into which I am about to introduce city water and plumbing; but there is no sewer nor likely to be one for a long time. I am reduced, therefore, to a cesspool, and the question is how best to construct it under the circumstances.

In "Plumbing Problems," you refer to Philbrick's "American Sanitary Engineering" for directions as to the proper construction of cesspools. But this book only speaks in a very general way about them and gives no detailed directions as to the proper construction of any but those connected with irrigation systems. Nor can I find sufficient directions about them in any of the text-books I have at hand. I presume a tight cesspool of brick laid in hydraulic cement is the only *absolutely* safe kind. But such a cesspool would have to be emptied at very frequent intervals, which would entail great expense. Is there any way of using the liquid contents on the ground on a half-acre lot without its being offensive?

Would there be serious danger from a leaching cesspool 60 feet from the house and 120 feet from the well, the water of which is in constant use, the well being on higher ground than the cesspool, with the house between the well and the cesspool? There is a good fall from the house to the cesspool. The soil is gravelly. The nearest neighbors are over 200 hundred yards away. I presume a cesspool ought to be ventilated. What is the best way of accomplishing this?

How large ought a cesspool to be in a house in which there are one bath, one water-closet, one set basin, one kitchen sink, one pantry sink, three laundry tubs, household of three or four persons, one or two of whom are apt to take a plunge bath every morning?

If the kitchen sink is provided with a good grease-trap, will there be any need for any other grease-traps in the system? Yours truly, ARCHITECT.

GALT, ONTARIO, August 10, 1887.

SIR: I desire to know how to construct a cheap cesspool for a country town where there is no sewer and where the rock is close to the surface, there being only one foot of loose earth on top of rock.

The people here have been in the habit of digging a large pit and filling it with cobble-stones, then letting the water, etc., soak through them. In my judgment, I condemn this system and suggest instead to build a vault and cement it tight, and when it fills pump it out after disinfecting it and use it on the farm. Am I right in doing so? An early reply will much oblige, Yours truly, C. FITZGERALD.

[The cesspool problem is a very perplexing one. All cesspools are objectionable. They necessarily retain putrescent matter to decompose and pollute the soil and air about the house, while the proper way is always to convey the refuse to a safe distance from the house without giving it time to become putrid. This is the office of a public sewer. Where no such works exist, and where water-closets are used, the cesspool becomes a necessary evil. Undoubtedly the best way to treat the sewage of a single house or group of houses is to distribute it on the ground on or near the surface. Where there is an acre or more of sloping land, this can be done easily, as described in Philbrick's "American Sanitary Engineering," pp. 91-94. If subsurface irrigation is preferred, the details are fully described in a small pamphlet entitled "The Disposal of Sewage in Suburban Residences," published by THE SANITARY ENGINEER AND CONSTRUCTION RECORD, and for sale at this office. All such methods presuppose an area of an acre, or nearly that, for every house, unless the soil be extremely porous or well drained and having a good slope, where a smaller area might answer, but rarely less than half an acre under the most favorable conditions.

Of course there are thousands of cases where the size of the lot is too small for such treatment. The alternative generally taken is to dig a porous cesspool, with walls laid up without mortar, and allow the contents to soak into the soil.

This method has a certain sanction afforded by its very general use, but it is not to be recommended, especially where the water-supply for drinking is taken from wells in the immediate neighborhood. The argument often heard that "the well is on higher ground than the cesspool" is not sound, unless the cesspool be lower than the *bottom* of the well, for that is the level from which most of the water is drawn. A distance of one or even two hundred feet does not insure immunity from soakage where the nature of the soil favors it. Even a rocky soil can convey water through cracks and seams in the ledge for a greater distance without great descent.

A clay soil is the softest, but no rule can be given as to any distance which would insure safety in any case, for the question is a blind one that no one can determine with any certainty. The only safe way is to abandon all thought of drawing drinking-water from the neighborhood of vaults and cesspools, or similar sources of pollution. Even then the soaking cesspool is continually accumulating foul matter, to putrefy at such a depth below the surface that it constitutes a hoard of poison which may become active when future houses are built on the spot. No lapse of time can be considered sufficient to purify these accumulations when covered up beneath the surface at such depths as to prevent the free circulation of air.

We, therefore, recommend *tight* basins for cesspools, made with walls of hard brick, two bricks thick, in hydraulic cement and plastered with the same inside like a rain-water cistern. Of course this method requires all the water-supply of the family to be pumped or otherwise removed from the cesspool at frequent intervals, which may be onerous where a flowing water-supply is used. This gives force to the maxim, often urged in these columns, that no public water-supply should be developed in any village without an intelligent and well-developed system of sewerage at the same time.

All communities who violate this rule are incurring risks which, in the light we now have on such subjects, are unjustifiable. The amount of risk may be small at first in many cases, but increasing population multiplies it unawares, till some fearful epidemic breaks out such as we often hear of in small villages where wells and cesspools are used.]

THE MECHANICAL TRADES OF PHILADELPHIA AND THE CENTENNIAL CELEBRATION.

(Special Correspondence.)

PHILADELPHIA, August 16, 1887.

THE mechanical trades of the city are taking much interest in the coming Constitutional Centennial celebration, and vast preparations are being made for participation in the mammoth street parade that is being arranged for. Nearly every branch of mechanics will be represented by exhibitions of the work, and in some cases with men actually engaged at work on floats drawn in the procession. The Master Builders' Exchange of this city has determined to be fully represented, and with that determination has appointed a committee to make the necessary arrangements.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We continue our report from the last issue :

In Section VIII., on Friday, the 12th inst., Professor E. J. James, of the University of Pennsylvania, read a paper entitled "The Testimony of Statistics to our National Progress," in which he sought to prove that recent articles by Mr. Edward Atkinson, of Boston, were too optimistic in their view of the situation and prospects of the laboring man in America. "The Rate of Interest Realized to Investors on the Bonded Securities of the Government" was the title of a paper by E. B. Elliot, of Washington.

In Section A, Alexander Macfarlane read two papers on the "Logical Form of Geometrical Theorems"; J. Burkitt Webb discussed the "Moment of Inertia"; T. C. Mendenhall read a paper on "The Eccentricities of Guessing"; "The Orbit of Hyperion" was the title of a paper by Ormond Stone; Dr. R. S. Woodward read a paper on "A Method of Computing the Secular Contraction of the Earth," and Henry M. Parkhurst discussed "The Photographic Observation of Asteroids."

In Section B, Professor J. Burkitt Webb, of Cornell University, read a paper on "A New Dynamo Metre"; a paper on "The Electro-Motive Force of Magnetization," by Professor E. L. Nichols and Professor W. S. Franklin, was followed by one on a "Description of a Combined Chronograph and Weight Motor," by Professor W. A. Rogers, of Waterville, Me.; Elias E. Ries, of Baltimore, then read a paper on "The Electric Current as a Means of increasing the Tractive Adhesion of Railway Motors and other Rolling Contacts"; Professor Rogers then read a "Description of a Combined Chronograph and Weight Motor," and the last paper of the morning was "Experimental Determination of Minimum Wind-Velocity in the Washington, O., Tornado," by Professor C. Leo Mees, of Athens, O.

The report of the Committee on "Uniform Methods of Stating the Results of Analyses of Mineral and Potable Waters" was presented in the Section of Chemistry. Professor W. H. Herrick read a paper on "Improvement in Standard for Electrolysis," which was followed by one by Professor W. O. Atwater, of Middletown, Conn., on "The Determination of Nitrogen by Soda-Lime." "A Note on the Chemistry of Germination" was read by Professor William McMurtre, of the University of Illinois. The other papers of the morning were: "Standardizing Hydrometers," by Professor F. G. Novy, of the University of Michigan; "Note on Absorption of Nitrogenous Nutrient by the Roots of Plants," by Professor McMurtre. In the evening a number of papers were read by Professor T. H. Norton, and one, written by Professor F. G. Novy, was read by Professor Prescott.

In the Section on Mechanical Science and Engineering, J. Burkitt Webb exhibited diagrams of a new steam-engine indicator. J. E. Dewnton talked about an improved arrangement of Siemens' platinum electrical pyrometer. T. C. Mendenhall and John Mack lectured on the "Uniformity of Planimeter Measurements." H. T. Eddy talked about "Reaction Polygons and their Properties."

In Section E, Geology and Geography, the day was devoted to a consideration and discussion of the report of the American Committee of the International Congress of Geologists. The report consisted of digests of the reports prepared by the several reporters appointed by the committee and intended to reflect the opinion of American geologists on the various subjects touched. The report was presented by its Secretary, Dr. Persifor Frazer, of Philadelphia.

In Section H, Professor Thomas Wilson, of Washington, read an interesting paper on the "History and Present Condition of Prehistoric Archaeology in Western Europe." This was followed by an interesting paper on "Relics of an Indian Hunting Ground," by Professor A. Wanner, of York, Pa. Dr. George F. Kunz read a paper on "A Gigantic Jadeite Votive Adze from Oaxaca, Mexico." Dr. Kunz also exhibited a remarkable crystal skull, and read a paper upon it. The evening was devoted to "The Assumed Mythical Character of Professor Heer's Atlantis Theory," by Professor J. Kost.

In the evening the Torrey Botanical Club gave a reception to the botanists of the association.

Saturday was given up to excursions to West Point and Long Branch.

On Monday several papers of particular interest to our readers were presented. Four papers were read on canals across the American isthmuses. Commander Taylor, U. S. N., discussing the general question of "Isthmian

Transit," concluded that the Panama Canal had proved a hopeless failure. He considered that a ship-railway across the Isthmus of Tehuantepec must also fail, and that the proper scheme was a canal across the Isthmus of Nicaragua. R. E. Peary, C. E., U. S. N., discussed the Nicaragua route in detail, and the surveys and plans of Engineer Menocal, U. S. N. Mr. Peary estimated the cost at \$64,043,699, and the time of construction at six years. Dr. J. F. Bransford, U. S. N., read a paper entitled "Climatic and Sanitary Notes on the Nicaragua Canal Route," giving an almost enthusiastic view of its health, and food and water-supplies. J. W. Miller discussed Nicaragua Lake as a harbor, and also gave a highly favorable opinion of the Isthmus as a canal route.

Professor George F. Barker read a paper by Thomas Edison on "A Machine for Producing Electricity Directly from Fuel," called the pyromagnetic dynamo; also a paper by the same author on "A Magnetic Bridge or Balance for Measuring Magnetic Conductivity." The following papers were also heard: "The Simultaneous Measurement of the Speed of an Engine and Dynamo by Electric Means," by Professor H. S. Carhart, of Ann Arbor, Mich.; "The Electrical Condition of the Atmosphere in Fair Weather and During Thunder Storms," by Professor T. C. Mendenhall and Professor A. L. McRae, of Terre Haute, Ind. Vice-President Anthony then closed the morning session of the section. "Time of Exposure and Mass Considered as Functions of the Rate of Saturation of Heat in the Case of Mercury and Water," by Professor W. A. Rogers, of Waterville, Me., and the "Definition of the Ohm by the Equation $R = K \cdot c \cdot s$," also by Professor Rogers; "A Peculiar Form of Undulatory Current Suited to Telegraphing or Telephone Circuits," by Professor P. H. Van der Weyde, of the New York Medical College; "Some Notes on Standard Cells," by Professor H. S. Carhart; "Certain Phenomena Produced by the Explosion of Gun Cotton on Metallic Plates," by Professor C. E. Monroe, of Newport, R. I.; "Experiments on the Viscosity of Oil," by Professor J. B. Webb; "Is Terrestrial Magnetism Concerned in Atmospheric Movements?" by Professor M. A. Veder, of Lyons, Wayne County, N. Y.; and "A Classification of the Winds," by Professor W. M. Davis.

On Tuesday several excursions were made and officers elected as follows:

President, Major J. W. Powell, United States Army, Washington; vice-presidents, by sections—Mathematics and Astronomy, Professor Ormond Stone, of the University of Virginia; Physics, Professor A. A. Michelson, of Cleveland, Ohio; Chemistry, Professor C. E. Monroe, of the United States Navy, Newport, R. I.; Mechanical Science, Professor C. W. Woodward, of the Washington University, St. Louis; Geology and Geography, Professor G. H. Cook, New Brunswick, N. J.; Biology, Professor C. V. Riley, Washington; Anthropology, Professor Charles C. Abbott, Trenton, N. J.; Economic Science and Statistics, Professor C. W. Smiley, Washington; permanent secretary, Professor F. W. Putnam, Cambridge; general secretary, Professor J. C. Arthur, Lafayette, Ind.; secretary of the council, Professor C. Leo Mees, Athens, Ohio; treasurer, William Lilly, Mauth Chunk; secretaries of sections in order, Professor C. L. Doolittle, Bethlehem, Pa.; Dr. A. L. Kimbal, Johns Hopkins University; Professor W. L. Dudley, Nashville; Professor George H. Williams, Johns Hopkins University; Professor Arthur Beardsley, Swarthmore College; Dr. N. L. Britton, Columbia College; Professor Frank Baker, Smithsonian Institute, and Professor Charles S. Hill, Washington. The next meeting will be held at Cleveland, beginning the fourth Wednesday in August, 1888.

The last session was held Tuesday evening. Votes of thanks to Columbia College and its president, to the various committees, and the ladies which have entertained the members were passed, and "Eli Perkins" provoked a laugh by a humorous address on "The Philosophy of Wit, Humor, and Satire."

DISINFECTANT FOR STREET EXCAVATIONS.

PARK COMMISSIONER JOHN D. CRIMMINS asked the New York Health Board for advice about the work of disinfecting the excavations for the electrical subways. After experiments by Dr. Edson and Dr. Martin, President Bayles sent the following letter to Contractor Crimmins:

"SIR: In reply to your valued favor of the 10th instant, asking the advice of the Department as to a disinfectant to be used along the line of the subway excavations, I have the honor to say that experiments conducted by the officers and chemists of the board during the past few days lead to the conclusion that the best material for your use is a solution of bromine in water. We have tested this solution on earth taken from the subway trench at Broadway and Twenty-seventh Street, and find it prompt and effective in action, especially in the presence of coal-gas and the products of its condensation. A pound of bromine in a barrel of water will give probably a solution of sufficient strength for your purpose. If you desire, we will prepare the solution in our laboratory, as it requires special skill in handling, and supply it to you at net cost, which will be not far from \$1 a barrel, enough, if our experiments can be accepted as conclusive, to render 200 feet of trench free from nuisance. One of our inspectors will be detailed to instruct in the economical use of the solution any person whom you may designate.

"With much respect, J. C. BAYLES."

ENGINEERS' CLUB OF KANSAS CITY.

IN place of the regular meeting of August 1, the club took an excursion to Sibley July 30, where the Chicago, Santa Fe and San Francisco Railway is to cross the Missouri, by invitation of Mr. Octave Chanute, Consulting Engineer of the works. There were, including ladies and other invited guests, fifty-two in the party.

Leaving the Kansas City Union Depot in a special car at 10:45 A. M. by the Wabash road, the party was joined at the junction with the bridge switch by Mr. I. F. Wallace, Resident Engineer at the bridge, who conducted the visitors to the scene of operations.

After examining the plans and materials, and the arrangements for prosecuting the work, they repaired to the private chair car, where they were served a bounteous and excellent lunch. Subsequently a few of the more adventurous men of the party descended into the caissons, from which they emerged a few moments later drenched and almost exhausted. They declared that the temperature of the outside atmosphere at 97° was wintry in comparison with the temperature (110°) which they experienced during their short stay in the caissons.

In the afternoon the guests were conducted aboard the contractor's steamboat by Mr. SooySmith, and took a short trip on the river.

They returned by special train to the Union Depot at 7:45 in the evening.

A vote of thanks was tendered to Messrs. Octave Chanute, I. F. Wallace, Charles SooySmith, and the Wabash Railway Company.

AMERICAN SOCIAL SCIENCE ASSOCIATION.

THE general meeting of this association for 1887 will be held at Saratoga, N. Y., from the 5th to the 10th of September, inclusive, opening at 8 P. M., September 5, with an address by the President, Carroll D. Wright, of Boston. The Department of Education will meet on Tuesday, September 6; the Health Department on Wednesday, September 7; the Department of Jurisprudence on Thursday, September 8; and the Social Economy Department on Friday, September 9.

THE laying of the intake-pipe for the Racine, Wis., Water-Works has just been completed. This involved the laying of 1½ miles of 24-inch iron pipe at an average depth of ten feet below the lake bottom. The contractors are Thatcher & Breyman; the dredging of the trench for the pipe was done by Starke Bros. Thatcher & Breyman are now laying 2,000 feet of pipe below river and lake for Sheboygan, Wis. The test of the Racine Water-Works will be made this week or next.

PERSONAL.

MAJOR JARED A. SMITH, U. S. Engineers, has been ordered to Fort Constitution and Jerry Point, N. H.

CHIEF NAVAL CONSTRUCTOR WILSON, U. S. N., has been ordered to inspect the Navy Yard at Portsmouth, N. H., also at Mare Island, Cal.

MR. STEVENSON TOWLE, ex-Chief Engineer of Sewers, Department of Public Works, will sail soon for Europe, to examine the systems of drainage and sewage disposal recently constructed there.

THE Secretary of the Navy has appointed a board of naval officers to examine the plans submitted by the Barrow Shipbuilding Company, of London, for an armored battle ship, and report on the probable cost of building the vessel. The members of the board: are Chief Constructor T. D. Wilson, President; Engineer-in-Chief George W. Melville, Captain George Brown, Assistant Naval Constructor Francis T. Bowles, and Assistant Naval Constructor Lewis Nixon.

DR. H. V. FERREL, of Williamson County, has been appointed a member of the State Board of Health of Illinois.

JAMES TAYLOR, who founded the Trenton, N. J., Pottery, died in that city, August 17, aged seventy-eight years.

SIR ROBERT RAWLINSON, C. B., has placed funds at the disposal of the Association of Sanitary Engineers and Surveyors to enable them to appoint a person to work up all the information accessible on the subject of "sewer ventilation."

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

DESIGNS FOR SOLDIERS' AND SAILORS' MEMORIAL.—The Commissioners for the State of Indiana will receive designs in competition for the Soldiers' and Sailors' Memorial and Monument at Indianapolis. The cost will be about \$200,000. The plans will be submitted to a board of experts for examination. They should be sent before December 12 to George J. Langdale, President of the Commission.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 372-376.

WATER, SEWERAGE, ETC.

PAWNEE CITY, NEB.—Will vote on bonds for water-works, \$28,300, September 12. A. A. Richardson is the engineer. Mr. Richardson's plans include a pumping-engine, stand-pipe, and 20,000 feet of water-pipe.

LA GRANGE, GEO.—Public sentiment here was so much against water-works that the town did not hold the election.

LOWELL, MICH.—We learn that water-works are to be built by the Lowell Water Co. The water is procured from wells. There is a reservoir and 150 feet fall; cost, about \$25,000, with 50 fire-hydrants. The works will be completed about December 1.

BUTLER, MO.—Our correspondent writes: "In reply to your inquiry I will state that we have taken no steps to establish water-works, but we intend to let a franchise to some company just as soon as we can get a reliable proposition that we can stand."

WILTON, IOWA.—"There has been nothing decided on in regard to water-works, but there has been a company formed for the purpose of drilling a hole 2,000 feet deep to see what can be developed in the way of coal, gas, or an artesian well. They are very confident that they will strike water, and if they get nothing else I suppose they will form a water-works company."—W. D. H.

OSCEOLA, MO.—Our correspondent writes: "The water-works question for Osceola has been indefinitely postponed. We found it would cost too much considering the population of our town—1,500."

GREENVILLE, MICH.—The question of obtaining water-works will be put to a vote of the people in about a week.

WELLSTON, O.—Our correspondent writes: "No preparations have been made as yet for water-works, but we expect to contract for water-works within the next sixty days."

TORONTO, ONT.—The committee of experts have reported on means of increasing the water-supply. The schemes presented, on which they were asked to make a report, fix the cost all the way from \$29,000 to \$48,000. All provide for new pumping-engines. The committee is Alan McDougall, George C. Robb, John Galt, William Hamilton.

COLUMBUS, O.—Is agitating the construction of an intercepting sewer.

MANKATO, MINN.—The City Engineer will advertise for proposals on constructing a water-works reservoir at once.

MONTGOMERY, ALA.—Mr. George E. Ellis has declined to undertake surveys for a system of sewerage. The work will be done by City Engineer Williamson and assistants.

LAPER, MICH.—The water-works committee have reported to councils in favor of building water-works at an estimated cost of \$30,000 to \$40,000. The question will be submitted to the citizens at a special election.

FARMINGTON, ME.—The water company will put in a system of water-works, also of electric-lights.

FORT SMITH, ARK.—James P. Bales, C. E., has finished surveys for the construction of sewers on plans by J. W. Neir, C. E. The main will be 46 inches in diameter and 7,530 feet long.

KINSLEY, KAN.—Our correspondent writes: "Our city has voted bonds for \$40,000 for the construction of water-works. Bonds have been sold and engineer is now working on plans and specifications which will probably be completed this week, when bids will be advertised for. We shall use the stand-pipe system and will lay about 4½ miles of main."

ATHOL, MASS.—Town-meeting August 12 voted to introduce a sewerage system and appropriated \$10,000 to begin work at once. In charge of the matter are Selectmen W. W. Fish, J. W. Goodman and J. F. Whitcomb.

SALT LAKE CITY, UTAH.—The construction of a reservoir in City Creek Canyon is agitated.

BURNET, TEX.—A contract has been made here for sinking an artesian well.

SHEBOYGAN FALLS, WIS.—proposes to build water-works.

READING, PA.—City Council has before it a letter from W. M. Griscom, of Berlin, on the subject of filtering the water-supply.

RUSHVILLE, IND.—An agitation has begun for obtaining a water-supply.

BOOTH BAY, ME.—wants water, and several parties have looked over the contract, but nothing definite has been done.

DETROIT, MICH.—Large quantities of new iron pipe has been ordered laid by the Water Board.

AUBURN, CAL.—will have a water-supply from Bear River ditch.

HALLOWELL, ME.—The Hallowell Water Company will build a reservoir near the city farm that will furnish a much larger and better supply than heretofore.

COLDWATER, MICH.—will vote September 1 on the question of water-works. The estimated cost is \$60,000.

WASHINGTON, D. C.—It is proposed to cut an artificial channel around the new reservoirs to carry flood-waters past them into the Potomac River, and prevent fouling of the reservoirs. The cost is estimated at \$130,000.

JERSEY CITY, N. J.—Contractor Fox has offered to sell to Jersey City all the title and interest in the works known as the Kearney Avenue Water-Main, including pipe, branches, gates, bridges, etc., connected therewith, for the sum of \$50,000. The contract price is \$61,861.20.

NICKERSON, KAN.—has voted \$32,000 for water-works.

GIRARD, KAN.—Incorporated is the Girard Water-Works Company by C. G. Hawley and others.

TITUSVILLE, FLA.—Address the Mayor for particulars about proposals to be advertised for water-works.

SANFORD, ME.—The Sanford Electric-Lighting Company has increased its capital, and will introduce water-works.

LAMAR, MO.—Francis Tiernan & Co. offer to take the stock and assume the debts of the Lamar Water and Gas Company, provided the city will take water from sixty hydrants, at \$60 per hydrant per annum.

LAKE, ILL.—The Trustees anticipate taking early action in the direction of increasing the water-supply. Several plans are being considered. The one which will probably be acted on is to construct a tunnel seven feet in diameter, leading from the shore-shaft to works at Fifty-ninth and Halsted Streets. It is estimated that the work could not be completed in less than two years. J. Frank Foster has been designated to make a preliminary examination.

MARIETTA, O.—has before its Council propositions for building water-works. The American Water-Works Company, of McKeesport, Pa., proposes to put down ten miles of pipe from 16 to 4 inches, put in a reservoir of not less than one and a half million gallons capacity; put in two pumps of three millions of gallons capacity in the twenty-four hours, and furnish the city with 120 fire-hydrants, at an annual rental of \$4,300, giving the city the right to purchase at intervals of five years. New York parties, represented by T. D. Dale, of Marietta, propose to put in ten and one-half miles of pipe, from 16 to 4 inches; duplex engines and pumps of two and a half millions of gallons capacity in twenty-four hours, a stand-pipe for reserve use of three hundred thousand gallons capacity; take the water from wells sunk at the edge of the river, furnish 75 fire-hydrants for \$1,750 annual rental, and furnish 50 additional fire-hydrants at \$500 annually. E. R. Davenport, of Charleston, W. Va., proposes to lay eleven miles of pipe, put in two engines, boilers, and pumps, the pumps to be of three million gallons capacity in twenty-four hours, filter the water, supply it by direct pressure and reservoir through the pipes; extend surface pipes for consumers to the curb stone, put in 125 fire-hydrants at an annual rental to the city of \$1,500.

ROCHESTER, N. Y.—Emil Kuichling will make surveys for a trunk sewer on the East Side; \$21,000 appropriated.

ROCHESTER, N. Y.—\$38,000 are to be expended on new water-mains. Address the Water-Works Committee of City Council.

SOUTHERIDGE, MASS.—has a Committee on Sewerage.

TARRYTOWN, N. Y.—On August 15 it was voted to raise \$100,000 for increasing the water-supply.

CLEVELAND, O.—An ordinance is under consideration making the City Civil Engineer, the Water-Works Engineer, the City Solicitor, and two citizens a Commission to prepare plans to prevent the sewage pollution of the Cuyahoga River, with an estimate of the cost of the necessary works.

Later.—The Commission has been appointed as follows: City Civil Engineer Rice; Water-Works Engineer Whitelaw; City Solicitor Brinsmade, and two citizens to be named hereafter.

AUSTIN, ILL.—A report has been received from the Special Water-Committee on a water-supply, on the cost of connecting with Chicago's mains. Their estimate was \$69,600. An estimate for pumping-engines and stand-pipe, not including water-mains, was presented at \$10,000. "Well men" are asked to submit propositions.

PROVIDENCE, R. I.—The contract for a 25,000,000-gallon reservoir on Fruit Hill has been given by the Board of Public Works to J. J. Neuman, of Providence, the lowest bidder.

GILROY, CAL.—A canal is to be dug from Frazier Lake, Old Gilroy, to the Pajaro River. This canal will drain and reclaim for pasture and cultivation about 2,000 acres of land.

MANCHESTER, VA.—John E. Taylor, Mayor, informs us that the City Council is entertaining propositions

in regard to water-supply and are "open for proposals." "Parties looking for conservative investment, I think, might find a first-rate chance here, as the surroundings are inviting for the building and operating of works." Address the Mayor for details.

POCAHONTAS, VA.—Our correspondent writes in reference to proposed water-works here: "We are not able to do anything about water-works now. It may be that the citizens would patronize any one who would come here and put up works at their own expense. It seems to me that a stock company might make money out of it."

JACKSON, MICH.—will obtain a supply of water from an artesian well—1,000,000 gallons daily.

MONTREAL, CAN.—We recently published the bids for furnishing pumping engines for the water-works. The City Council, August 15, awarded the contract, for local reasons, to E. E. Gilbert, of Montreal.

KINGSTON, JAMAICA.—Colonel George E. Waring's report on the sewerage of Kingston, recently sent to Mayor and Council, proposes the separate system with flush-tanks, and an outfall so situated as to be convenient to a sewage-farm should that hereafter be used. The main sewer varies from 12 to 18 inches in diameter, with 6-inch laterals and 4-inch private connections. The estimate of cost is £27,992 (about \$135,000.)

COLORADO SPRINGS, COL.—H. C. Lowrie, C. E., of Denver, will make an estimate and report to Council on the cost of water-works.

Mt. CLEMENS, MICH.—The Mt. Clemens Water-Supply Company has been incorporated by F. G. Kendrick, W. J. Daley, and others.

TOPEKA, KAN.—Incorporated is the Topeka Land and Water Power Company; William Tweddle, J. M. Currier, and others.

AUSTIN, MINN.—The National Iron and Brass Works, of Dubuque, Iowa, has been awarded contract for water-works system at \$36,000.

MALDEN, MASS.—The Aldermen have appropriated \$5,000 to the making of experiments with driven wells.

ANTWERP, N. Y.—Address G. H. Heywood regarding water-works.

TIPTON, IOWA.—is agitating obtaining artesian wells as a source of water-supply.

NEWARK, N. J.—Incorporated is the Southern Gas Trust and Construction Company; Frank P. Mercereau and Harry G. Payne, of Pulaski, Fla., and John M. Dow, of Newark. The capital is \$100,000, and business is to be begun on \$25,000. The business is to be the construction and running of gas and water-works in Newark and various places in Florida.

CARPENTERIA, CAL.—Mr. Hogue will furnish a water-supply from artesian wells.

JAMESTOWN, N. Y.—The water company is prospecting for new sources of supply and test wells will be sunk in the Levant.

MILWAUKEE, WIS.—Common Council Committee has reported favoring an appropriation of \$17,000 to begun work on the flushing tunnel.

PORT FULTON, IND.—The Trustees have granted permission to the Water-Works Company to lay water-mains.

JEFFERSONVILLE, IND.—Plans and surveys for the water-works are finished and work will soon be begun.

FREDERICK, MD.—Our correspondent writes: "In seasons of great drought our city's present water-supply, derived principally from a stream called the 'Big Tuscaraora,' situated about six miles west of Frederick, is hardly adequate to the wants of the city, and our authorities consequently have taken some action looking toward an increased supply. This can probably be had from another stream lying between Frederick and the stream of present supply. However, surveys are likely to be made of other streams lying farther away of greater capacity. I am uncertain whether it is the design of our Board of Aldermen to push this matter right along now or only to acquire the necessary facts as to cost, etc., for use in the near future."

GAS, STEAM, BUILDINGS, ETC.

ROCHESTER, MINN.—Walker, O'Mulcahy & Henessey have been granted a twenty years' franchise to manufacture gas here. The work will begin soon. The price of gas must not exceed \$2 per 1,000 feet.

STILLWATER, MINN.—The Excelsior Electric-Light Company and the Stillwater Gas Company have consolidated.

DULUTH.—The electric-light company has increased its capital stock to \$50,000. A new building to cost \$5,000 will be put up. The plant will be increased to 175 2,000-candle-power lights; a new 150-horse-power Corliss engine will be put in, and two new dynamos added. A \$20,000 addition to the City Hotel will be built.

F. A. SAWYER, of Portland, and others have bought the Biddeford, Me., and Saco Company's gas-plant.

GOVERNMENT, N. Y.—An electric-light company has been formed here with E. D. Harry, President, W. F. Ludds, Vice-President; C. Arthur Parker, Secretary. The American arc-light will be used.

CHATTANOOGA, TENN.—Natural-gas is reported to be found at the Logan well. The well is sunk by the Chattanooga Oil and Gas Company; George McGranahan is engineer.

CHICAGO.—Parties interested in gas-works supplies should watch developments here. The Gas-Light and Coke Company will issue bonds to a very large amount, and apply the proceeds to large extensions of the plant.

COLUMBUS, O.—The gas company has taken measures to supply gas for heating.

LEWISTON, ME.—A Committee of Council has been appointed to obtain propositions for lighting the streets with arc-lights.

BRIDGEPORT.—The Aldermen here voted to contract with the Bridgeport Electric-Light Company for five years for electric-lights on the following basis: Lights to burn all night; fifty-three cents per lamp per night if contract is made for three years, and fifty cents if for five years. The latter proposition is accepted.

KENSINGTON, ILL.—Incorporated is the Kensington Electric-Light Company of Kensington; capital, \$20,000; incorporators, Burt Williams, James O'Brien, William Birdsall, Erastus Gates, and John Heaton.

COLUMBUS, MISS.—The gas-works will be enlarged. T. Byron is Superintendent.

TUSCALOOSA, ALA.—Gas-works will be built here by the Tuscaloosa Coal, Iron, and Land Company.

OWENSBORO, KY.—H. D. Fitch, of Louisville, will rebuild the gas-works here. About \$60,000 will be expended.

CHICAGO.—Capitalists have undertaken a search for natural-gas in this vicinity. Joseph Oaks and J. J. Dugan, of Indiana Avenue, are experts in the matter.

PHILADELPHIA.—A charter has been granted to the Steam-Heating Company, of Philadelphia; capital, \$400,000.

ST. PAUL.—Incorporated is the Duluth Natural-Gas, Oil and Mineral Company. Capital stock, \$100,000. Incorporators: W. A. Foote, J. D. Ray, J. R. Carey, L. Mendenhall, J. H. Triggs, N. J. Miller, S. E. Cheeseman.

ALBERT LEA, MINN.—A company with a capital stock of \$150,000 has been organized to be known as the Minnesota Natural-Gas and Fuel Company.

EASTON, PA.—The Easton Market Company intends to heat its building with steam. The building is not under roof yet. Any one addressing to D. W. Neven, Easton, Pa., will get all information desired.

ST. PAUL, MINN.—Incorporated is the Minnesota Oil Company; capital stock, \$250,000. The object of the company is to mine and bore for gas, oil, salt, and other mineral substances in Wyoming County, N. Y. The incorporators are W. H. Jennings, Walter Alexander, A. D. Stephens, T. J. Thorson, M. Scheller, H. A. Mason, and W. T. Zwickley, of Crookston; A. E. Johnson, of St. Paul, and C. A. Chiniuvy, of Chicago.

SACO, ME.—F. A. Sawyer, of Portland, Col. Steadman, of New York, with Horace Woodman, of this place, have negotiated for the purchase of the Biddeford and Saco Gas Company's plant, the money to be paid and the subscribers to take possession October 1. It is understood that the purchase is made for the Traders' Electric-Light Co., of Biddeford.

COLUMBIA, PA.—The town has contracted with the Columbia Electric-Light Company to furnish electric-lamps for street-lighting for one year.

LEWISTON, ME.—The city government has passed an order looking to the establishment of an electric-light plant for lighting the city.

BROOKLYN.—Samuel H. Hoffman, of St. Louis, is the lowest bidder for mason-work on the new Amphion Academy on Bedford Avenue, and he has the contract. The heating and ventilation has been given to R. A. Goodchild, for the Hankins heating and ventilating system.

RAILROADS, BRIDGES, CANALS.

ST. PAUL.—The Minnesota Railway and Navigation Company has filed articles of incorporation with the Secretary of State. The project has already been referred to in these columns. The capital stock is \$10,000,000. The incorporators are Ansel Oppenheim, W. H. Knowlton, Mark D. Flower, C. W. Bunn, John I. Thompson, William Dawson, Jr., F. W. Davis, Arnold Kalman, and R. C. Wright, all of St. Paul. The object is the building of a line of road from St. Paul and Minneapolis to a point on Lake Superior.

AUSTIN, MINN.—County Commissioners have let contract for three iron bridges to N. E. Horton, Rochester, Minn., \$7,574.

MEMPHIS, TENN.—The charter for the Jackson Mound Park Railroad Company has been filed. The following gentlemen are the incorporators: A. Vaccaro, E. L. Golbaum, Joe Mancini, Sol Coleman, John W. Cochran, D. Zellner, B. M. Stratton, C. W. Schulte, Holmes Cummings, and Theodore Kregel.

BIRMINGHAM, ALA.—The stockholders of the Birmingham and Northwestern Railroad have met and organized a company by the election of the following officers: T. M. R. Tacon, of Mobile, president; H. Tacon, of Mobile, secretary and treasurer; William Inge, of Corinth, Miss., general counselor, and a board of directors. A large corps of surveyors are in the field now and it is given out that the building of the road will be pushed as early as possible.

DECATUR, ILL.—The directors of the Louisville and Nashville Railroad have decided to erect their shops here at once. They will consolidate all their locomotive-works and car-building shops into one immense concern.

CANALS.—Surveys for the American canals are being made by Mr. J. Page, Chief Engineer of the Department of Railways and Canals of Canada.

TENNESSEE RAILROADS.—A corps of engineers has begun work on the survey of the Nashville and Tuscaloosa Railroad. The road is in operation twenty miles south-west from Centerville to Etowah.

The engineering corps of the Tennessee Midland Railroad will this week begin the survey of a new route from the Cincinnati Southern Railroad to the Virginia line.

The Paducah and Tennessee Railroad Company has been organized in Paris, Henry County. R. L. Ellison is President, T. H. Puricar, Vice-President, and J. L. Lemonds, Secretary and Treasurer.

LOUISVILLE, KY.—The Louisville and Jeffersonville Bridge Company have ordered the engineer to make surveys for a bridge over the river.

BATH, ME.—The City Council have contracted with the Bath Electric Power Co., to light the streets with 20-arc lamps, each 10,000 candle-power, for \$2,000 per year, to be running by the middle of October.

MEMPHIS, TENN.—The Chesapeake, Ohio and Western Railway will build a depot to cost about \$600,000. The contract has been let.

NEW BRUNSWICK, ME.—The survey has been made for the New Brunswick Railway, through Houlton to Titcomb's mill.

LAFAYETTE, TEX.—The contracts for the construction of the Mexican National Railroad were signed August 11 with Hampson & Thornton. They agree, according to the terms of the contracts, to complete the work within one year and are to break dirt within ten days.

CHATTANOOGA, TENN.—A contract for the construction of the Chattanooga, Rome and Columbus Railroad has been awarded and work begun. This road is a new line, extending south from Chattanooga to Columbus, Ga., a distance of 230 miles, and is to be completed within eleven months.

WOONSOCKET, R. I.—The Town Council has voted to accept the report of the committee recommending that a bridge be built over the Blackstone River after plans by William Kent, C. E. The cost of bridge and approaches is estimated at \$22,000.

TAUNTON, MASS.—The Pennsylvania Bridge Company has the contract for building an iron bridge over the river at the pumping-station. The price was \$4,635.

LINCOLN, NEB.—Bonds have been voted to the Salina, Lincoln and Pacific Railroad, in Glendale and Pleasant Valley townships, Salina County. This completes the franchise from Salina to Lincoln, and insures the building of this road by the Rock Island.

PHILADELPHIA, PA.—Charters have been granted to the Susquehanna Building and Loan Association, No. 2, of Philadelphia, capital \$1,000,000, and to the Norristown Land and Improvement Company, capital \$100,000.

NEW BRUNSWICK, N. J.—The Board of Aldermen have received a favorable report from the committee appointed to investigate the Vanderpool electric system of street road lighting, and a resolution was framed giving the City Railroad Company the right to erect poles along its route, provided no opposition was encountered from property-owners.

MEMPHIS, TENN.—Contracts for the grading for that part of the Tennessee Midland Railway between Memphis and the Tennessee River, a distance of 135 miles, were awarded July 27 to the following parties: Robert Johnson, Memphis, Tenn., 10 miles; Cook & Gaines, Princeton, Ky., 10 miles; McGowan & Brown, Holly Springs, Miss., 11 miles; W. Ferguson & Co., Danville, Tenn., 10 miles; H. C. Tate & Co., Memphis, Tenn., 13 miles; J. S. McTigue & Co., Memphis, Tenn., 50 miles; Finlay & Clayton, Tupelo, Miss., 12 miles; John L. Wisdom & Co., Jackson, Tenn., 10 miles. For freighting and piling, to Cook & Gaines, Princeton, Ky.; F. L. & C. J. Houser, Gadsden, Ala.; R. D. Lawrence, Aberdeen, Miss. For cross-ties to D. H. Pitts & Co., Scottsville, Va.; Brittain, Pearce & Co., Jackson, Tenn.; and D. H. Pitts & Co., Scottsville, Va.

EASTON, PA.—The American Pneumatic Railway Company, of Philadelphia, proposes to build a line here, one mile long.

TOPEKA, KAN.—Articles of incorporation of the Chicago, St. Paul and Kansas City road were filed in the office of the Secretary of State August 1. The term of existence of the corporation is ninety-nine years, and the capital stock is \$15,000,000. The first board of directors will be composed of E. W. Pierce, St. Louis; Edward R. Rose, J. F. Harris, C. F. Hamilton, M. C. Hage, and G. H. Gerber, Salina, Kan.; and F. Allen, Deltor, Mo. The object is to construct a railroad as follows: Main line to run from a point on the north line of the Naugas, on the north line of Washington or Republic County to a point on the south line of Barber County and west line of Meade County. The length of the main line is 350 miles. Three branches are also to be constructed, two of them 200 miles long and one 250 miles.

ROME, GEO.—The Rome Land Company wants dummy-engines for the street-car line.

NEW YORK CITY.—The Martin Anti-fire Car-Heater Company, of Dunkirk, N. Y., has signed a contract to place in the cars of the New York Central and Hudson River Railroad their system of car-heating. The contract will involve an expenditure by the Central of over \$600,000.

MARINETTE, WIS.—has voted to build a bridge over the Menomonee River, at a cost of \$50,000.

SAN DIEGO, CAL.—The San Diego and International Railroad Company has filed articles of incorporation to build a five-mile steam railroad, telegraph and telephone line from the head of San Diego Bay to the north boundary-line of Mexico. The incorporators and trustees of the company are Charles F. Francisco, Riley R. Morrison, David Gochenauer, William Gardner, and G. Y. Gray. The capital stock is \$150,000, divided into 1,500 shares.

KEENE, N. H.—The Keene Street Railway Company organized August 10 with the Hon. A. T. Batchelder, President; the Hon. Charles H. Henry, Clerk; William B. Fink, Treasurer; directors, C. J. Woodward, John S. Blodgett, Andrew H. Hayes, Charles R. Corning. It is proposed to build the road at once.

BOSTON.—By a vote of the directors of the Consolidated Street Railway Company all the horse-car lines in Boston are placed under one management. The consolidation is the last of a series, and it now controls many miles of road.

NEWARK, N. J.—The Newark and Irvington Cable Street Railway Company have received permission to lay the cables and will proceed with the work.

BROOKLYN and Jamaica Plank Road Railroad Company has contracted with the Vandepole Electric Manufacturing Company to construct an electric railway.

DENVER, COL.—Address the City Engineer in regard to a \$35,000 bridge to be built on Nineteenth Street.

ROME, GEO.—W. G. Gamma, Chairman of Committee of Roads and Revenue, should be addressed in regard to two bridges at this place.

SAN FRANCISCO, CAL.—Articles of incorporation of the Winters and Ukiah Railroad Company have been filed in the County Clerk's office. The road is to com-

mence in Yolo County, running northwesterly up Berryessa Valley to Clear Lake and thence to Ukiah. The length is 105 miles. The directors are Charles F. Crocker, Timothy Hopkins, W. V. Huntington, S. F. Gage, and N. T. Smith; capital stock, \$4,000,000.

BRIDGE.—The Penn Bridge Company, of Beaver Falls, Pa., has been chartered with a capital of \$50,000.

ROCHESTER, N. Y.—City Surveyor Quinn is preparing specifications for an iron bridge over the river at the Driving Park; estimated cost, \$75,000.

DULUTH.—A belt and terminal railway company will be organized with the following incorporators: William F. Phelps, Secretary of Chamber of Commerce; Mayor J. B. Sathp'n, J. D. Ensign, R. S. Munger, M. R. Baldwin, Colonel C. H. Grove, L. Mendenhall, Asa Daily, W. W. Wilson, J. J. Ray, J. R. Myers, G. G. Hartley, and M. B. Harrison.

JAMESTOWN, DAK.—The contract for a 12-stall addition to the Northern Pacific Railway round house has been let to contractor Bjourquist, of Moorehead, for about \$17,000.

MILWAUKEE.—Adolph Toellner and others are experimenting on State Street with an electric motor for street railways. If successful, a franchise will be granted to them. Wires are strung on both rails and eight miles an hour up the hill on Seventh Street will be made.

The Hinsey ordinance provides for a street railway in Milwaukee on Broadway from Wisconsin to Oneida, thence to Sixth Street, thence to Centre and West to city limits.

KANSAS CITY, MO.—The Kansas City and Sabine Pass Railway Company has filed articles of incorporation and received a charter for the State of Missouri, with a capital of \$2,500,000. Col. Harrison M. James, of New York, is President and Fred M. Day, of Brooklyn, Treasurer. The object is to build an air-line road from Kansas City to Sabine Pass, 700 miles.

ST. LOUIS, MO.—Morrison & Corthell, of Chicago, are making plans for the new bridge over the Mississippi River.

AUGUSTA, GEO.—The Augusta Construction Company has been organized to build the Augusta and Chattanooga Railroad. J. P. Verdery, W. B. Lowe, W. M. Bird, J. P. Bondurant, and others, of Augusta, are members of the company.

STREET WORK AND PAVING.

ST. PAUL.—The Board of Public Works have confirmed assessments for paving as follows:

Rosabel, from Eighth to Tenth; Eighth, from Locust to Wabash; Fillmore Avenue, from Dakota Avenue to State; street next to the Mississippi River, from Chestnut to James.

The board has advertised for bids for the improvement of Summit Avenue, from Lexington Avenue to the edge of the bluff near the Mississippi. The following is an approximate estimate of the work to be done:

Excavation, 235,000 cubic yards; embankment, including surfacing for roadways, 100,500 cubic yards; soil filling for boulevards, 39,760 cubic yards; timber, 40,000 feet; stone gutter, 1,935 square yards; slope wall, 100 cubic yards.

MORRISTOWN, PA.—It is proposed to lay out a new street from Sandy Hill to Main Street. A large amount of stone wall will have to be built. The matter is in charge of the Town Council Committee on Streets, Roads and Bridges.

HARRISBURG, PA.—Howell & Gruber, of Lancaster, have received the contract for furnishing and putting in place 4,200 feet of granite curbing on Market Street.

FREEPORT, ILL.—Incorporated is the Taylor Park Company; John B. Taylor, Joseph S. Buck, Edward C. Warner.

SAN ANTONIO, TEX.—Address the City Engineer in regard to the proposed improvement of Cameron Street.

BIDS OPENED.

BOSTON, MASS., August 12 (Special).—The only proposal received to-day by the Park Commissioners for a bridge on the Agassiz Road, Back Bay Park, was from Thomas A. Rowe, whose bid was \$34,814. The contract will probably be advertised again.

CAMDEN, N. J.—Council Committee has opened bids and awarded contracts as follows on street work: Filling Kaiga Avenue to Cooper's Creek, Frank C. Somers, \$4,500; estimated quantity, 25,000 cubic yards. Paving Koyden, Main, and Vine Streets, William H. Sherman, \$2.05 per square yard.

Paving Third Street, Aaron Ward, 72 cents per square yard; Garrett Miller, 69 cents; W. H. Sherman, 53 cents (awarded).

Building Line Street sewer, 5'x3'4", 16 feet excavation, William Thompson, \$8.25 per foot; W. B. Pine, \$7.97; Aaron Ward, \$7.61 (awarded).

Building an egg-shaped sewer on Liberty and Fourth Streets, equal to a 2-foot circular sewer, Aaron Ward, \$1.19 per foot; William Thompson, \$1.13; W. B. Pine, \$1.03 (awarded).

NASHVILLE, TENN.—The following bids for constructing a masonry reservoir (capacity 50,000,000 gallons) were received by the Board of Public Works and Affairs August 9:

Williams & Tolmie, Nashville, \$741,180.

W. B. Beach & Co., \$603,887.

Owen Patterson, Baltimore, Md., \$474,750.

Gilbert Patterson, Washington, D. C., \$438,910.

Smith, Leonard & Munford, Niagara Falls, N. Y., \$435,954.

Meyer & Alexander, Nashville, \$429,930.

Houston & Freeman, Glendale, O., \$400,955.

Southern Construction and Quarry Company, Nashville, \$359,272.

Hicks, Holmes & Co., Indianapolis, Ind., \$359,022.50.

Harold McDonald & Co., Pittsburg, \$352,302.60.

R. P. McClure, St. Louis, \$337,905.

Smith, Waters & Co., Baltimore, \$336,712.

Whitsit & Adams, Indianapolis, \$330,921.

The Board decided to award the contract to Whitsit & Adams, of Indianapolis. They guarantee to finish the reservoir within the next twenty to twenty-four months.

LITTLE ROCK, ARK.—Synopsis of bids for Sewer District No. 2, total length of sewer, 4,680 feet, F. J. Rickon, engineer to the board:

E. W. Weigel & Co., excavation and back filling, 20c. per foot; pipe laying, 12c. per foot; manholes, \$13 each; flush-tanks, \$60 each.

N. H. Wordswell, excavation, back filling, and pipe laying, 32c. per foot.

Thompson, excavation, back filling, and pipe laying, 32c. per foot.

G. R. C. Rumbaugh, to complete work, \$3,900.

The contract was let to E. W. Weigel & Company.

The Falls City Sewer Pipe and Terra Cotta Company, of Louisville, Ky., has the contract for furnishing the pipe, etc.

The system is small pipes and flush-tanks.

Bids for constructing the Harvard Bridge over the Charles River, between Boston and Cambridge, were opened August 15 by the Harvard Bridge Commissioners, as follows:

1. Dredging 5,000 cubic yards.....	\$4.40
2. Spruce piles, 2x4x10.....	4.50
3. Curbing, 1,800 lineal feet.....	7.25
4. Portland concrete, 2,670 cubic yards.....	5.00
5. Pier masonry, 3,710.....	17.76
6. Coping masonry, 554.....	21.00
Total.....	\$122,850.00
John Shields and John Carroll, Boston.	
Boynton Bros., Boston.	
Mt. Waldo Granite Works, Frankford, Me.	
Joseph H. White & Co., Boston.	
C. H. Edwards and G. H. Cavanagh, Boston.	
D. Connelly & Co., Boston.	
Trumbull, Cheney, Hayes & Co., Boston.	
William H. Ward, Lowell.	

The contract was awarded to Shields & Carroll.

CINCINNATI, O.—Bids for granite-paving, etc., on Eastern Avenue were opened by the Board of Public Affairs August 10. Estimate of quantities:

Curbs, 5-inch granite, 22,900 lineal feet; curbs, circular, 450 lineal feet; curb, reset, 4-inch granite, 200 lineal feet; curb, reset, 5-inch granite, 100 lineal feet; crossings, 1,120 lineal feet; grading, 30,300 cubic yards; granite, 51,800 square yards; hydraulic cement, 8,750 cubic yards; rolling, 54,500 square yards; readjusting manholes, 5; twelve-inch pipe, 500 lineal feet; paving street intersections, 800 square yards; paving street gutters, 200 lineal feet; rubble masonry, 50 cubic yards; covered gutters, 300 lineal feet.

The lowest bidders were G. Eyerman & Co., prices as follows: curbs, 5-inch, \$1.15 per foot, total, \$26,335; curbs, circular, 5-inch, \$2.30 per foot, total, \$1,035; curbs, reset, 4-inch, 5 cents per foot, total, \$10; curbs, reset, 5-inch, 5 cents per foot, total, \$5; curbs, reset, 6-inch, 5 cents per foot, total, \$5; crossings, \$7.15 per foot, total, \$3,580; gradings, 5 cents per cubic yard, total, \$15,015; granite, \$3.30 per square yard, total, \$170,940; hydraulic cement, \$4.70 per cubic yard, total, \$41,125; rolling, 5 cents per square yard, total, \$2,725; readjusting manholes, \$2 each, total, \$10; 12-inch pipe, \$1.50 per foot, total, \$750; paving street intersections, 50 cents per square yard, total, \$400; paving street gutters, 15 cents per lineal foot, total, \$30; rubble masonry, \$5 per cubic yard, total, \$250; covered gutters, \$1.50 per lineal foot, total, \$450; grand total, \$262,673.

The other bidders were: T. M. Steel, \$295,084.50; S. W. Ramp, \$290,000.10; M. J. Dady, \$270,108.50; E. Kirchner & Co., \$265,602; Folz, Ashmun & Co., \$369,300.50.

GLOUCESTER, PA.—J. P. Eyre & Co., of Philadelphia, have contracted to build a pier for the Gloucester Iron Works, at \$11,243.

WESTERLY, R. I.—The contract for laying the west side Shunoc-Water extension has been given to F. A. Snow.

BOSTON.—The commissioners on the new courthouse in Boston have received the following proposals for masonry work in the erection of the northerly section from the second floor level: Messrs. W. A. & H. A. Root, \$148,980.14; Woodbury & Leighton, \$145,659; Augustus Lothrop, \$142,257; Sampson, Clark & Co., \$139,909. The commissioners have the proposals under consideration.

Frank Blandell, of Lynn, has been awarded the contract to build a stone-arched bridge over State Street on the West Roxbury branch of the Boston and Providence Railroad, to replace the iron bridge that fell on March 14. The price to be paid is about \$60,000.

MINNEAPOLIS.—The Haxton Steam-Heating Co. has been awarded contract for steam-heating in school buildings at about \$50,000. Architect Pardee has submitted plans of the new school building, corner Sixth Street and Eighth Avenue South, to cost \$30,000.

BOSTON.—The City Engineer at noon on Thursday received the following proposals for repairing waterways of Congress Street bridge-draw: Josiah Shaw, \$11,007.90; J. N. Hayes & Co., \$12,000; Benjamin Young, \$11,840; W. A. Kenrick & Son, \$11,250; Alexander McInnis & C. W. Parker, \$10,568.43; F. G. Whitcomb, \$10,261. The contract was awarded to Mr. Whitcomb.

TRENTON, N. J.—On August 18 a contract for masonry work on the State Lunatic Asylum was given to F. S. Johnson at \$65,000, and a contract for carpenter work to James W. Lanning at \$28,000.

PORT HURON, MICH.—The following bids for a 5,000,000-gallon set of compound pumping machinery were received by the Board of Water Commissioner: August 15: George F. Blake Manufacturing Co., New York, \$23,920; Henry R. Worthington, New York, \$23,300; Dean Steam-Pump Co., Holyoke, Mass., \$22,033; Holly Manufacturing Co., Lockport, N. Y., \$19,000.

MINNEAPOLIS, MINN.—On August 15 Council Committee opened bids for constructing the Franklin Avenue bridge. Two sets of plans and estimates were bid on as follows: Plans A and C, King Bridge Co., Cleveland, O., \$81,500; Horace E. Horton, Rochester, Minn., \$80,000; Smith Bridge Co., Toledo, O., \$49,141; Schiffer Bridge Co., Pittsburg, \$81,605; Canton Bridge Co., Canton, O., \$89,000; Edgemoor Iron Co., New Jersey, \$90,500; Milwaukee Bridge Co., \$86,000; Minneapolis Bridge Co., \$83,468; Lowell & Curtiss, Pittsburg, \$81,900.

Plans B and D, King Bridge Co., \$78,000; Smith Bridge Co., \$80,248; Schiffer Bridge Co., \$79,300; Lowell & Curtiss, \$91,900; Canton Bridge Co., \$81,000; Minneapolis Bridge Co., \$81,318. The City Engineer will report.

GOVERNMENT WORK.

ABSTRACT of proposals opened Monday, August 15, by Major S. M. Mansfield, U. S. Engineers, for rebuilding the superstructure of crib-work surrounding the keeper's dwelling at Milwaukee, Wis., pier-head light-station:

Christopher H. Starke, Milwaukee, Wis., pine timber, 126,328 feet, B. M., per M. \$18; pine plank, 24,000 feet, B. M., per M. \$18; drift-bolts, 10,500 pounds, per pound 4 cents; spikes, 1,800 pounds, per pound 5 cents; stone ballast, 150 cords, per cord \$7.25; framing, 150,328 feet, B. M., per M. \$18; total, \$7,000.37.

William T. Casgrain, Milwaukee, Wis., \$17.90, 3 cents, 4 cents, \$7.90, \$16; total, \$6,668.12.

Hiero B. Herr & Co., Chicago, Ill., \$16, \$14, 4 cents, 5 cents, \$8, \$15; total, \$6,322.17.

MONTGOMERY, ALA.—The following bids for furnishing machinery for maneuvering lock-gates and culvert-gates on Coosa River were received by Captain R. L. Hoxie, U. S. Engineers, August 11:

Manly & Cooper Manufacturing Company, Philadelphia, Pa., \$1,700.

Montgomery Iron Works, Montgomery, Ala., \$4,100.

Synopsis of bids for iron columns and beams from third story to ninth floor of tower for Post-Office, etc., at Minneapolis, Minn., opened by the Supervising Architect, August 11: Dearborn Foundry Co., \$7,500; Clark, Raffin & Co., \$6,680.

WASHINGTON, D. C.—Bids for tin and tin-work on Pension Building opened August 8 by General M. C. Meigs, supervising architect:

Merchant & Co., New York, tin, per box, \$6.70; solder, per pound, 15½ cents, 15½ cents; nails, 5½ cents per pound.

Morgan, Thomas & Co., \$6.87½, \$7, \$7.12½.

Morgan, Thomas & Co., work, per square, \$2.87½.

J. W. Considine, work, per square, \$3.37½.

W. J. Ferguson, work, per square, \$2.

S. G. Bouis, work, per square, \$1.95; lowest for work.

J. B. Scott & Co., letter of explanation of bid.

A. Schultz & Co., solder, 14½ cents.

Fisher & Johnson, work, per square, \$4.45.

J. B. Scott & Co., tin, per box, \$6.12½; lowest for tin.

Thomas Binnix, work, per square, \$3.40.

Phelps, Dodge & Co., tin, \$6.50; solder, 15½ cents.

W. F. Potts & Co., tin, \$6.75.

W. F. Potts & Co., solder, 14½.

NAVY YARDS.—The Secretary of the Navy has directed that \$75,000 shall be expended at each of the navy yards at Brooklyn and Norfolk for men, tools, and plant.

WASHINGTON, D. C.—Contracts for building the cruisers and gunboats under bids recently opened by the Navy Department have been awarded as follows: Cruiser No. 3 (the Newark) to William Cramp & Sons, of Philadelphia, at \$1,248,000; Cruiser No. 4 to the Union Iron Works, of San Francisco, at \$1,428,000. Department's plans for hull and machinery.

Cruiser No. 5 (Similar to No. 4) to William Cramp & Sons at \$1,350,000, contractors plans for hull and machinery.

Two 1,700-ton gunboats to N. F. Palmer & Co., New York, at \$490,000 each, Department's plans.

WASHINGTON.—Captain James B. Quinn, United States Engineer, in his annual report recommends the appropriation of \$160,000 for expenditure the next fiscal year upon the Missouri River from Sioux City to Fort Benton.

ABSTRACT of proposals for bridge over the eastern branch of the Potomac River at Washington, D. C., opened by Major Peter C. Haines, U. S. A.:

Mt. Vernon Bridge Co., Mt. Vernon, O., \$148,000.

Mt. Vernon Bridge Co., Mt. Vernon, O., \$127,000, if iron structure be accepted.

Groton Bridge Mfg. Co., Groton, N. Y., \$105,000.

Pittsburg Bridge Co., Pittsburg, Pa., \$123,000.

Smith Bridge Co., Toledo, O., \$150,000.

Synopsis of bids for superstructure, roof, and floors of Post-Office, Court-House, etc., at Augusta, Me., opened by the Supervising Architect August 15:

Maine and New Hampshire Granite Co., Portland, Me., \$74,700.

Horace Purinton & Co., Augusta, Me., \$74,875.

Hallowell Granite Works, Hallowell, Me., \$72,797.

Mt. Waldo Granite Works, New York City, N. Y., \$79,000.

Note.—All stone granite, with coursed Ashlar, and No. 8 cut trimming, courses and groins.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 13. } PUBLISHED EVERY SATURDAY.

NEW YORK, AUGUST 27, 1887.
LONDON, SEPTEMBER 10, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & CO., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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THE BURIAL OF SEWAGE AND REFUSE.

AT tolerably regular intervals during the last ten years some one makes the discovery that the disposal of sewage by water-carriage is a bad thing, and proceeds to announce to the ignorant engineers who have been dealing with this problem that the true and only way to dispose of refuse and excreta is to follow Nature and bring it in contact with the earth as soon as possible. The latest specimen of this kind of instruction is contained in an address by Dr. G. V. Poore, of London, on "The Shortcomings of Some Modern Sanitary Methods," a title which has a curiously familiar aspect. He declares that the admixture of water with dead organic matters is wrong, because it is antagonistic to a law of Nature; because it disseminates disease; because it fouls water-supplies, etc., etc., and his remedy is to bury all excreta and refuse just beneath the surface of the ground.

Many things connected with civilization, and without which civilization is impossible, are antagonistic to a law of Nature in Dr. Poore's interpretation of that very vague and improper phrase. Most of his objections and criticisms relate to bad work, and there is just enough truth in them to make the address interesting to those who know little of the subject, but who want to prevent any action being taken in their own town or village, and will gladly seize on any argument which will prevent their being taxed for sewers.

By ignoring all questions as to the disposal of slop-water, by quietly assuming that the only thing which pollutes water is excreta, by refusing to consider the question as to how all refuse and excreta are to be buried in cities, and dealing only with the problem of scattered villages and cottages, it is possible to devise a great variety of schemes which can be made to appear more or less attractive. No one would suppose, from anything that appears in Dr. Poore's address, that the criticisms he makes had ever been made before, that the method he proposes had not been tried and found wanting, that its expense makes it impossible to carry out, or that his arguments about the value and importance of excreta as a fertilizer were not duly considered by engineers in every case where they have to deal with the problem of sewage disposal. He hardly even hints that in different localities different methods of disposal of refuse and excreta may be desirable, recognizes no difference in soils, has no reference to sewage irrigation—in short, nothing will do for him except to allow no water to be mixed with the excreta, and to bury these last in the ground near the house.

Such opinions and views would be of the smallest possible interest and importance to sanitary officials and engineers who have to deal practically with difficult problems of refuse and sewage disposal of towns and cities, were it not for the use made of them by ignorant demagogues to oppose efforts to secure sewerage for cities badly in need of it.

It is, however, about time that some such scheme as that of Dr. Poore's should appear; it has been a year or more since we have had one of this kind, and this one comes in time to assure us that the average crop of such literature is not yet falling off.

WELL-WATER.

THE great majority of the people in this country obtain their drinking-water from the moving sheet of water which lies at a greater or less depth beneath the surface of the earth, and for this purpose they use wells.

The questions as to how far, and under what circumstances, well-water may be dangerously contaminated, and how such contamination may be best recognized when present, or be foreseen and guarded against, are therefore of constant interest. The Journal of the Chemical Society for June, of this year, contains a paper by Robert Warington, entitled "A Contribution to the Study of Well-Water," which is of more than ordinary value and interest. In this paper is given the results of a continuous and systematic examination of the well-waters of Rothampsted, England, and of the connection between the composition of rain, drainage, and deep-well waters. Taking a series of observations for several years it was found that the rain contained, in a million parts, an average of two parts of chlorine, 0.67 part of combined nitrogen, and 2.52 parts of sulphuric acid. By drainage through five feet of bare soil the quantity of chlorine is not increased, but the combined nitrogen is increased about nine times by oxidation of the organic matter in the soil. The production of nitrates occurs chiefly in the summer months, and the first considerable drainage which occurs after summer will contain the greatest proportion of the nitrates.

Nitrates being assimilated by plants are generally absent in drainage from land bearing an actively growing crop. The proportion of chlorine in the purest wells at Harpenden is about eleven per million, and it varies very little. Wells in soil much contaminated by sewage may show the commencement of a rise in the chlorides one or two months after the active autumn drainage begins, and two months before the water-level in the well begins to rise. Wells little liable to contamination show a rise in chlorides later in the season. When soil has been long contaminated by sewage, and then fresh contamination ceases for a number of years, the proportion of chlorides in the well-water may be considerably higher than normal, but it will remain nearly unaltered through the drainage season.

In contaminated well-waters the proportion of nitrates and chlorides increases at first at an equal rate, but if active drainage continues the proportion of nitrates greatly increases. The sewage of a poorly-fed population gives a high proportion of chlorides to nitrates, while stable sewage causes the reverse. The chloride contamination is more permanent than that by nitrates. The probable average proportion of nitrogen as nitrates in drainage water from cultivated land is 3.8 per million.

The examinations of waters made by Mr. Warington were almost entirely chemical; the only exception was a series of experiments which indicated that a nitrifying micro-organism is contained in deep-well waters, but in very small proportions.

DEATH OF PROFESSOR BAIRD.

THE death of Professor Spencer F. Baird, the Secretary of the Smithsonian Institution, is a great loss to this country and to the world. He was born at Reading, Pa., February 3, 1823, and died at Wood's Holl, Mass., August 19,

1887. In his early life he was a naturalist and a teacher, but for the last thirty-seven years has been connected with the Smithsonian Institution, and has been the chief agent in forming its collections and in the organization of the National Museum. In 1871 he was appointed United States Fish Commissioner, and in that capacity has done most important work in increasing the food-supply of this country, and in determining the directions in which this kind of work may be profitably extended. For the last eight years he has been at the head of the Smithsonian Institution.

A large, powerful man, full of vitality and energy, it seemed as if he could not do too much or have too much to do; but it is to be feared that overwork was in part, at least, the cause of his death. He was solely devoted to science and scientific interests, was a member of many societies, and received many honors. He lived to see his work established on a firm foundation, and his death is regretted not only by all who knew him, but by many who never saw him.

MR. W. H. PREECE recently read a paper before the Society of Arts on "Fifty Years' Progress in Telegraphy." Speaking of underground wires, he says: "In London alone we have 255

as \$1,000 had already been paid down to bind the transaction. The agent was obliged to refund this sum. This is a very satisfactory result of the trouble taken to prepare the articles.

OUR BRITISH CORRESPONDENCE.

A Technical Instruction Bill—Tenth Annual Congress of the Sanitary Institute—Compressed Air for Working Electric Motors—Tight Fish Plates—Law Suit over a Brick Tank—American Metallic Packing in London—Underground Telephones.

LONDON, August 3, 1887.

A "TECHNICAL instruction bill" now before Parliament is creating considerable discussion. Its object is to authorize school boards to provide technical schools and instruction. Complaint is already frequently made that the education given at the board schools does not stop at the "three R's," but that a child attending there may obtain better education than can be afforded to his family by many a middle-class man who has to pay school-board rates. The prospect of an enhanced rate for the purpose of providing technical education to children of the artisan class is not, therefore, favorably received.

The tenth annual congress and exhibition of the Sanitary Institute will be held at Bolton in September, the congress taking place on the 20th to the 24th of Septem-

rails to expand under the great heat that we have lately experienced, causing them therefore to buckle up between the plates and distort the metals.

The Mersey Railway in its extension to join the Wirral Railway has met with several difficulties during its construction. An action has been brought against it by the Birkenhead Corporation in connection with fractures in a brick tank destined for a new gas-holder which the corporation have under construction. Mr. Woods, President of the Institution of Civil Engineers, and Sir James Brunlees gave evidence for the railway company, who, in this case, had a verdict awarded to them on the ground that the said fractures were not due to their work.

THE United States Metallic Packing Company have scored with their metallic packing with the London and South-western Railway, notwithstanding the fact that there are several metallic packings of English manufacture in the market. The locomotive superintendent of this railway states that it is giving every satisfaction and will effect a considerable saving in the way of piston-rods and cost of labor, while the glands do not require packing so frequently.

The first departure in the way of underground telephones has been made in the city where a small section has been laid down in Broad Street for the purpose of testing the system.

SAFETY-VALVE.



A STABLE AT WENTWORTH HALL, JACKSON, N. H.—W. A. BATES, ARCHITECT.

miles of pipe, containing 10,212 miles of wire. In fact, all our great trunk lines are out of danger of stoppage from storms. We have 868 miles of open wire included within the metropolitan area, but these are chiefly in the suburbs, and include long outlying sections, used either for police or fire brigade wires, or for private persons. There are 213 offices in London now served wholly by buried wires."

It appears that in 1886 there were in the United Kingdom 26,425 miles of overhead telegraph lines, embracing 150,590 miles of wire, and 677 miles of underground lines, with 19,605 miles of wire. It is estimated that to connect only the more important towns by underground wires, and "uniting those towns by less than half the existing number of overhead wires, would cost something like £2,500,000." Of submarine cable there are now 112,673 nautical miles, which has absorbed a capital of £37,000,000. The larger part of this, or 102,531 miles, is owned by 27 private companies, having from 1 to 53 cables each.

WE have learned that an exposure of bad plumbing in a certain dwelling which was recently made in this journal was the means of warning an innocent buyer against the purchase of one of a block of buildings which were not at the time fit habitations for human beings. The warning came just in time to prevent the purchase,

under the presidency of Lord Basing. There will be three sections: (1) Sanitary Science and Preventive Medicine, commencing September 21, the opening address by Prof. J. Russell Reynolds, M. D., F. R. S., F. R. C. P.; (2) Engineering and Architecture, September 22, opening address by Prof. T. Hayter Lewis, F. S. A., F. R. I. B. A.; (3) Chemistry, Meteorology, and Geology, September 23, opening address by August Duprè, Ph. D., F. C. S., F. R. S. Papers on the various subjects concerned are invited by the council of the institute.

A company has been formed in Paris for the purpose of supplying compressed air for working electric motors, obviating the necessity of engines, boilers, etc. Mains are being laid through Paris, connecting the various public buildings where it is intended to supersede gas by electric light, with a central station for compressing the air by engines of 3,000 horse-power (total). With such facility for driving the motors, and the safety consequent, electric-lighting will undoubtedly receive an impetus.

It has hitherto been supposed that tight fish-plates are an advantage. It would seem, however, from evidence given before a Board of Trade inquiry, appointed in the case of an accident, that such is not the case. An express train ran off the metals at a point where the rails had buckled up. Space had been left in the joint to allow for expansion, but it was discovered that the tightness of the Ibbotson's patent fish-plates had prevented the

THE MILWAUKEE SEWERAGE PROBLEM.

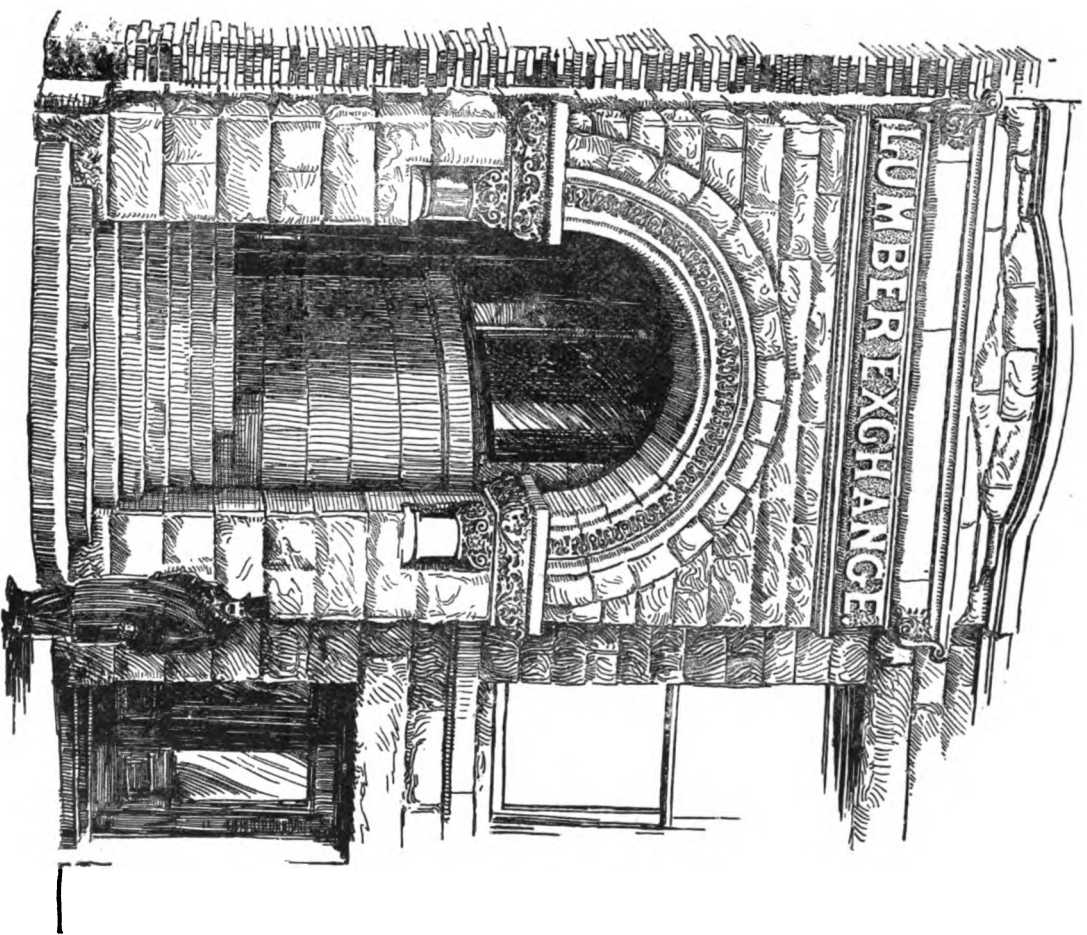
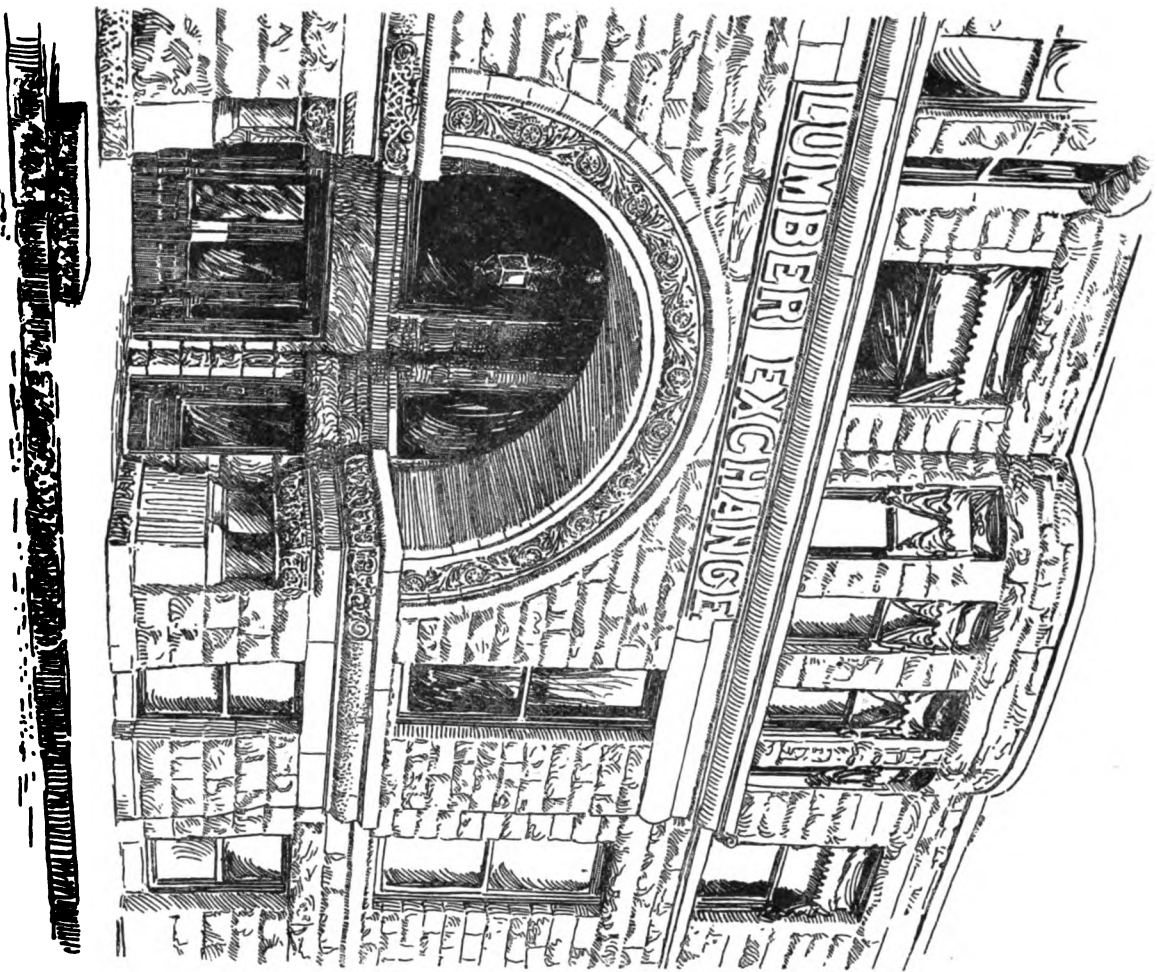
WE are glad to note that the Mayor of Milwaukee and the Board of Debt Commissioners have decided to act under the law passed by the last Legislature authorizing the expenditure of half a million dollars in measures for the relief of their river nuisance. It is to be hoped that the city officials, who seem to be infatuated with the idea of flushing the river, will conclude that the only sensible thing for honest and intelligent men to do is to secure the services of acknowledged experts in this branch of engineering to consult with their city engineers and then promptly authorize the execution of the plan such a commission will recommend.

OUR SPECIAL ILLUSTRATION.

OUR special illustration this week shows two views of the Lumber Exchange at Minneapolis, Minn., of which Messrs. Long & Kees were the architects.

OUR VIGNETTE ILLUSTRATION.

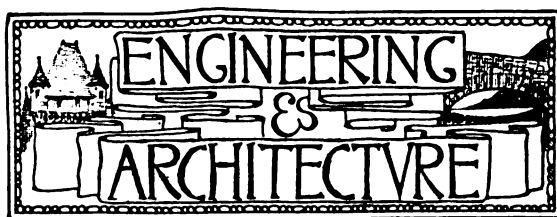
OUR vignette illustration this week shows the Wentworth Hall Stables at Jackson, N. H. The exterior is shingled in staves, and accommodates ninety horses, with boxes, etc. The cost of the structure was \$9,000. The architect was W. A. Bates, of 149 Broadway, New York.



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

LUMBER EXCHANGE, MINNEAPOLIS, MINN.

LONG & KEES, ARCHITECTS.



THE ARCHITECTURAL LEAGUE'S JAUNT.

It was not a very happy lot of members of the New York Architectural League who went ashore from the steamer "Providence," of the old Colony Line, at Newport, at 5 A. M. of the 19th inst. They had not gone to bed early, most of them had slept but little, it was very early in the morning, and they were in the confines of a Prohibition State.

They tumbled into their carriages, however, and, after leaving bags, etc., at the Aquidneck, drove to the beach and tumbled into the surf, which, in its early morning strength, returned their blow with interest.

Just before this latter act the secretary—may he be perpetual—had produced a queer-looking nickel-plated instrument strongly resembling a conductor's bell-punch, but which he gravely assured every one was a detective camera, and after much posing and struggling and straddling about of the group of blue-clad, half naked subjects, he had sighted them, pulled a string—and they had become immortal.

Back to breakfast—a ceremony at which eight strongly-built colored men found it difficult to furnish food to appease voracious appetites.

Carriages at nine, and, after a long drive about the old town, the procession drew up at Mr. Cornelius Vanderbilt's house—formerly Mr. Lorillard's—and was received by Mr. Vanderbilt personally, who showed the points of interest.

Since buying the house he has added a new dining-room—a splendid apartment some 60x40 feet, finished in stained oak, but which is handicapped by an unfortunately designed ceiling. The breakfast-room—another alteration—is exceedingly nice, being a very simple treatment, with delicately-modeled plaster-work, the whole having an effect of a pleasant saffron yellow.

Then a walk about the grounds and into the children's house, though not before Mr. Vanderbilt had shown that prohibition laws were not universal.

From here, by foot along the sea-walk to McKim, Mead & White's house for Mr. Robert Goellet, at which some time was spent. Then to Mr. H. A. C. Taylor's house by the same architects. A nice treatment of an old colonial motive in white and pale pumpkin yellow, the interior very simple and quiet. Thence, by devious ways, to Mr. Samuel Coleman's house, which was perhaps the gem of those visited in Newport.

The exterior is very nice, while the interior, done in great part by the artist himself, is a most charming and delightful piece of color. The library is jewel-like.

From here to the Casino, where every one lunched and walked about until it was time to take the train for Boston, at which city all arrived at 5:40 P. M. and drove to the Parker House. About seven the representatives of the Boston Society of Architects arrived and all dined, and a very good dinner it was, interspersed with songs by the "sweet singer" and dialect tales by W. P. P. Longfellow. Mr. Rotch Ware set loose a flood of talk by some remarks upon architectural co-operation, and this was supplemented by Mr. Briggs in a few words on specialists, but by eleven o'clock everybody found that everybody else was of his mind and that early rising was not conducive to argument, and everybody said good-night and went to bed.

On Saturday morning carriages to Brookline, driving out through Commonwealth Avenue and the Back Bay, and after quite a journey to Mr. Harney's house for Mr. Schlessenger. A very nice house on the English country house plan, built some twelve years ago. Time was short, so with but a look here all arrived at the house which E. M. Wheelwright is completing for Mr. William Weld. A fine house on a splendid site, standing as it does on top of a hill, with far-reaching views in every direction. The house is very large, the first story of what are called "Tiffany" brick, with sills and lintels and a porch of a light stone. Above is all shingle-work, stained. The interior is very fine, the best, perhaps, of all those seen. It would be well worth while to describe the house in detail did space permit. The decoration of the drawing-

room was by Francis Lathrop, and there were two charming rooms by John L. Du Fais.

It was a dusty ride back to Boston with a stop at Trinity Church and a hurried visit to Kings Chapel, but by 2:45 every one was on the train for North Easton to see Mr. Richardson's work there.

Oliver Ames, 2nd, met us at the lodge and showed us over that and the house and grounds. Then to the Town Hall and the Library. All these works are so well known that a description is unnecessary. But a feast still remained in the memorial window which John La Farge designed for the village church. It is a perfect gem and glow of lovely color, and it was difficult to leave it and take the train which took us to Fall River and so back to New York early Sunday morning.

It was a most successful outing, all too short, and the league owes a debt of gratitude to its Committee on Current Work, who arranged it.

It is difficult to calculate the benefit which such excursions may work, binding as they must the widely-separated members of the profession, giving opportunity for comparison of methods and results, and fostering a feeling of friendly rivalry and emulation.

It is to be regretted that more members of the league did not avail themselves of the opportunity. Among those from the Boston society who dined on Friday were Messrs. Rotch Ware, E. M. Wheelwright, H. Langford Warren, and W. P. P. Longfellow, and among the number from New York were John L. Du Fais, the President; Charles I. Berg, Secretary; H. O. Avery, Warren R. Briggs, B. Collona, W. C. Hazlett, George Martin Huss, Charles R. Lamb, F. S. Lamb, Charles T. Mott, W. Rudolph O'Donovan, the sculptor; E. K. Rossiter, J. H. Taft, and F. A. Wright.

COSTLY DRAINAGE WORK IN NEW YORK DESTROYED.

GENERAL EGBERT L. VIELE made a statement to a New York *Tribune* reporter, that drains constructed on the west side of Central Park in this city at a cost of \$300,000 to remove the water from underground water-courses and make the locality fit for building sites are being closed up by builders in their building operations, thus destroying an important work and producing a dampness of building sites.

It is unfortunate that the Health Department has not now the power to control this matter. But the facts are that a law was passed by the Legislature some years ago authorizing the Department of Public Works to construct drains within the city limits whenever so directed by the Health Department.

Under this law large areas were drained on the east and westerly sides of the city; but the authority to enter private property for this purpose was contested by some property owners in the court, which decided in their favor, throwing the whole expense on the city. The authorities therefore consider themselves powerless to control these drains. May be Mayor Hewitt can institute an inquiry that will result in a way being found to stop this mischievous work.

PRIVATE WATER COMPANIES.

MR. H. F. DUNHAM, the writer of the paper upon "Private Water Companies," read at Minneapolis and briefly referred to in our issue of July 23, desires us to say that one sentence in our notice might lead to a wrong impression. Our report stated that the writer "took general ground in favor of private companies when ordinances were properly guarded." The paper which we published in the issue of July 30, it will be seen, was limited to a discussion of the relations often existing between private companies and municipal authorities, and no opinion as to the comparative merits of company and city works was expressed.

THE Chicago, Santa Fe and San Francisco Railroad bridge at Sibley, Mo., will consist of three spans of 400 feet each, one span 250 feet, one span 200 feet, and two spans of 175 feet each, making the entire length of the main structure 2,000 feet. It will be approached on the north side by an iron trestle 900 feet long, and a wooden trestle 3,700 feet long, making the entire length of the bridge and approaches 6,600 feet.

AFTER a number of months' trial the system of "building-permit fees" has been abolished at Minneapolis, and a resolution will come up before the city council recommending that all fees paid in during the trial have been in force be refunded.

PAVEMENTS IN THE CITY OF LONDON.

FROM the last report of Mr. William Haywood, Engineer of the city, which, it must be remembered, is a small portion only of the great metropolis, we gather some interesting items as to the present ideas of the English engineers on pavements.

The carriageways on portions of three streets have been laid with Val de Travers compressed asphalt. Another street which had been paved with Henson's wood pavement was also relaid in the same asphalt, the wood having become in bad condition.

Four streets had been laid with Limmer compressed asphalt. Two others which had been paved with wood, and were in bad condition, were also relaid with the Limmer asphalt.

Wood pavement was renewed in three streets and parts of streets.

Granite was used in two streets, but the "relaying of streets with granite diminishes yearly, wood and asphalt (principally the latter) gradually being substituted for granite in the city."

For footways Val de Travers compressed asphalt was used in four streets, Limmer asphalt in six streets, and stone in five streets.

The whole of the carriageways are swept once daily, and the main thoroughfares, in wet weather, swept a second time during the day.

In addition to the general cleansing of the whole surface, the street orderly system was in operation on the carriageways of all the main thoroughfares, about 150 boys being employed for that purpose. The great advantage of this street orderly system is most apparent in wet weather, the thoroughfares where they are employed being at such times in a much greater state of cleanliness than they are elsewhere.

The work of cleansing the main thoroughfares often begins as early as two, three, or four o'clock in the morning. The street orderlies then take up the work at about 7:30 A. M., and cease work at about 4:30 P. M.; late in the evening, when the weather permits, or the condition of the surface renders it necessary, the carriageway pavements are washed. The cleansing of the carriageways in the main streets is, therefore, almost continuously going on.

The quantity of water used during the year 1886, for washing the streets and courts, was about 2,247,790 gallons. The number of nights when the water was used was 88.

The footway pavements are swept by the Commission whenever it is necessary, and in wet weather those in the main thoroughfares are cleansed with squeegees during the day. It is a statutory obligation on the part of the occupiers of property to keep the footways clean in front of their premises, an obligation but little attended to by the inhabitants in any part of the city.

The courts and alleys inhabited by the poorer classes were washed with jet and hose twice a week between May and the end of October. A very few places are washed nightly throughout the year for special reasons.

The street orderlies and scavengers have for some years been occupied at times in strewing sand and gravel upon the streets which have the greatest traffic. The average quantity so strewn during the last three years has been about 650 cubic yards, and the tendency is for it to increase. The extra work in removing this quantity of material when converted into mud is, in some states of the weather, very great indeed, especially from wood pavements. This circumstance also adds to the difficulty of keeping the streets clean, as well as to the cost of cleansing.

The engineer complains of the troubles arising from the collection of house refuse, owing to the abuse of the privilege allowed of placing their dust and refuse on the footways in receptacles of insufficient size, or with none at all.

THE Passaic, N. J., City Council proposes to establish a city board of health. The method of organization is under discussion.

THE Wheeling, W. Va., Citizens' Railway Company has begun the introduction of electro-motors for its street-cars, with the expectation of reducing running expenses.

THE MOLTENO RESERVOIR AT CAPE TOWN, AFRICA.*

ALTHOUGH the subject of this paper does not deal with anything striking or original, it may be interesting as the history of the failure of a reservoir, and the measures taken for its repair, as it is often the case that failures afford valuable information, however dearly bought.

Cape Town cannot be regarded in the same light as large manufacturing towns in England, yet its importance as a coaling and military station must be considered. Soldiers and ships require a supply of water which would almost equal the amount necessary for manufacturing purposes, especially in a town of 35,000 inhabitants, while in a tropical climate, anything like a water-famine would lead to greater distress than in a more temperate latitude.

Abundance of water of the purest description should be available, the rainfall fluctuating between 24 inches in depth on the north-west, and nearly 50 inches on the south-east around Table Mountain.

The largest sources of water-supply lie at a considerable distance up Table Mountain.

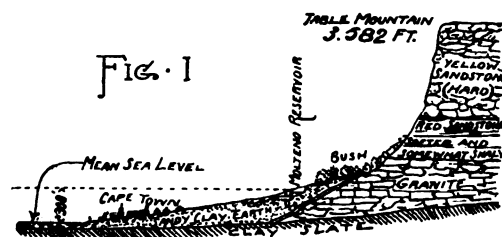
Nearly all the rainfall occurs in the months of May, June, July, and August: it is therefore absolutely necessary to have some large impounding reservoir to hold at least 100 days' supply.

As is usually the case with towns in their infancy, Cape Town was originally supplied by wells and pumps, each person obtaining the water in buckets or barrels. In 1819 a small reservoir was constructed at the foot of Table Mountain holding 223,251 gallons, and the water from Platte Klipp formed the source of supply. In 1852 a second reservoir was constructed holding 2,337,834 gallons, and in 1860 a larger one was added capable of holding 12,500,000 gallons. As the town extended in area and increased in importance, it was found that these reservoirs were of insufficient capacity for the wants of the population, and that they also lay so low as to preclude the possibility of supplying the higher portions of the town that had sprung up in prosperous times. Under these circumstances it was determined to build a new reservoir, at an elevation that should command the whole town, and of such a size as to give an ample supply of water to the population, and to the shipping during the dry season.

A scheme was devised for the construction of a reservoir above the two existing ones at an elevation of 300 feet above the level of the sea, capable of holding 50,000,000 gallons. See Fig. 1.

The soil where the reservoir is excavated is a red sandy clay-earth formed by debris from Table Mountain, and is traversed by quartz bands and earth-washings brought down by heavy rain; it dissolves rapidly under the action of water, leaving a deposit of 90 per cent. of sand. Veins of quartz extend from south-east to north-west, a few of which were found in the ground excavated for the reservoir. One peculiarity of the soil is, that it stands almost vertically until attacked by water, which rapidly cuts furrows in it, soon assuming large proportions. The author found it easy to tunnel through this earth without timbering in dry weather, but as soon as rain came it had to be supported.

The reservoir was designed and constructed under the supervision of Mr. J. Tennant, the contractor being the late Mr. James, and was completed on the 1st of March, 1881.



The reservoir is situated at the base of Table Mountain. It is 1,000 feet long by 300 feet wide and 50 feet deep, partly built by excavation, and partly by embankments round three sides. No water was available for the reservoir until the 4th of May, owing to the supply-works not having been completed before the end of the rainy season. When the water had reached a depth of one foot six inches at the outlet works or valve-shaft, which was situated in the eastern embankment, one of the wing-walls leading to the valve-shaft, or tower, fell over (see Fig. 2), drawing a portion of the shaft with it. These wing-walls were merely revetment walls, and were not built as retaining-walls, although it must have been evident they would be subject to considerable pressure. Mr. Swallow, the City Engineer, then proposed to abandon the greater portion of the wing-walls, and to construct a culvert from the valve-shaft to a forebay in the reservoir. The work was completed and an official opening took place on the 21st of July, 1881.

When a depth of ten feet of water was subsequently obtained, a leak was discovered in the tunnel; the water was thereupon run off, and a portion of the puddle removed from the back of the valve-shaft, and on the culvert being reached a gap was found over the top of the arch of the outlet-culvert large enough for a man to creep into. This chasm was filled up by running in puddle, a very unsatisfactory proceeding, as it had to be driven in horizontally, and with insufficient space in which to work.

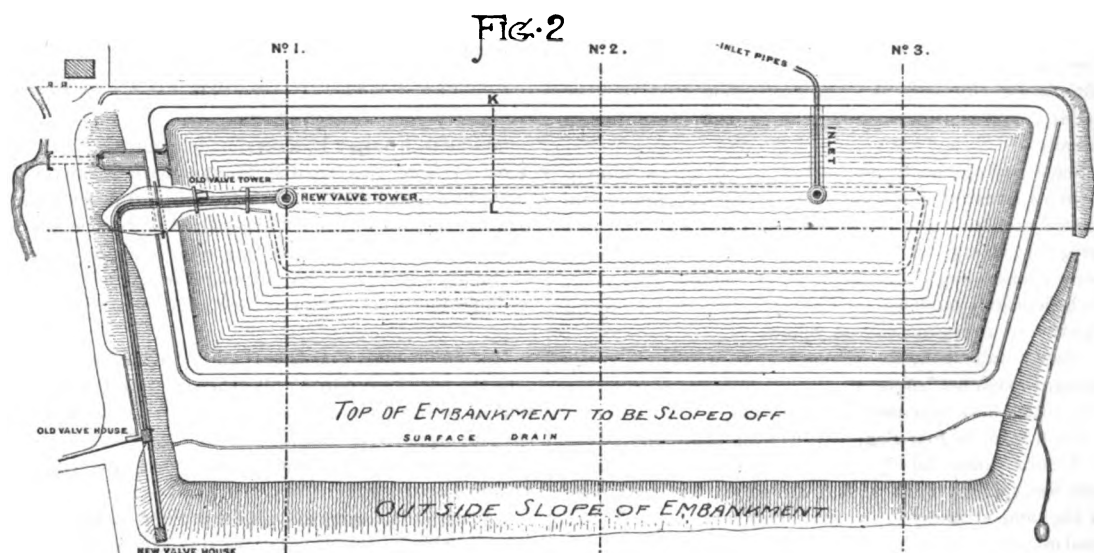
* By Charles John Wood, M. Inst. C. E., in proceedings of the Institution of Civil Engineers.

Round the back of the valve-shaft (Fig. 3) a bed of cement-concrete was placed, and the puddle relaid to the top of the embankment. On the 21st of September, 1881, water was again admitted to the reservoir, and a depth of 12 feet 6 inches was obtained, more not being procurable that season. On the 2d of April, 1882, the filling of the reservoir was recommenced, and by the 26th of the same month the water reached a depth of 14 feet when a fresh leak was discovered. A hole was now sunk perpendicularly over the culvert near to the puddle core, and it was found that a crack $1\frac{1}{2}$ inches wide extended almost perpendicularly 20 feet down the puddle core, and appeared to traverse across it completely. This crack seemed to have been caused through shrinkage of the puddle over the culvert, the clay being of a very inferior and sandy quality.

When the culvert was reached, a space was discovered between the brick-work and the original ground which had been filled up with puddle. The space was now found to have developed through the puddle-core to a height of between 12 and 18 inches, and was at once filled up. Water was again admitted to the reservoir until a depth of 27 feet was reached, when another leak commenced; a portion of the puddle at the valve-shaft was again removed, and it was discovered that the masonry had been so badly constructed, that streams of water were pouring through the joints, disintegrating and dissolving the puddle.

The damage having been repaired, the water reached a depth of 35 feet; but it was considered advisable to lower it to 31 feet, and at this depth it remained for a period of three weeks. At midnight on the 23d of August the night watchman reported a serious leak, but this stopped almost immediately. It was, however, deemed necessary to lower the water in the reservoir as speedily as possible, and bags full of clay were kept ready near the valve-shaft for effecting repairs in case of any hole showing itself. All went well, the water lowering at a good speed, when on Sunday morning, the 27th of August, 1882, a serious leak

material thus excavated forming the embankment, which is of enormous proportions, the northern embankment being over 100 feet wide at the top. The bottom of the reservoir was stated to be puddled for a depth of two feet; the author, however, could not discern any difference between the natural ground and the so-called puddle. The slopes were also supposed to be overlaid by one foot of puddle protected by a layer of pitching eight inches thick; but the above remarks will also apply to this puddle. Along the centre of the embankment a puddle-trench had been made, which only extended to about two feet below the bottom of the reservoir; if, therefore, downward percolation took place in the floor of the reservoir, there was nothing to hinder the water from getting away. The author caused the pitching to be stripped for a width of fifty feet at what appeared to be rather a suspicious place, but found that, with the exception of the bank having slightly settled in certain places, there was no indication either in it, or in the solid ground below, of any water having passed through. It appeared, therefore, that any leakage from the reservoir would probably have arisen from the water passing underneath the puddle-trench. As the greater part of the clay to be obtained in the neighborhood was of too sandy a nature to make the reservoir water-tight, and lining the reservoir entirely with stone would have been too expensive, the author determined to cover the bottom and sides with concrete to a height of thirty feet from the floor, thus keeping the lining entirely in the solid. The floor was accordingly excavated to a depth of two feet, and was recovered in the following manner: A bed of one foot of six to one concrete was deposited over the floor, and covered with a layer of cement-mortar in the proportion of one part cement to one part sand; this in its turn was covered with eleven inches of six to one concrete. The floor, and for ten to twelve feet up the sides, was formed in this manner; and from this point up to a height of thirty feet from the floor, all the sides were covered by a layer of concrete eighteen inches thick. The cement used for concrete was brought from England, and



PLAN OF MOLTENO RESERVOIR

again broke into the culvert, and gradually increased to such an extent as to carry away the filling-in round the culvert. The water thus obtained an unobstructed passage to the valve-house, at the north-east toe of the embankment, and down to the city, where it flooded several streets. With great difficulty the flow was checked at the side of the shaft, and a depth of 20 feet of water still being retained in the reservoir, it was gradually consumed for the supply of the city, the whole being exhausted by the 10th of July, 1883. Comparatively little damage was caused by the rush of water through the streets, and it may be looked upon as fortunate that the whole body of water in the reservoir did not force its way into the city. It will be seen from Fig. 3 that the leak commenced at a considerable height above the culvert, passing through the puddle-core; and it is evident that the space between the outlet-culvert and the ground excavated for its construction, not having been properly filled in, had caused the settling of the puddle-core and the subsequent cracks. This space having been reached by the water would enlarge very rapidly, owing to the inferior quality of the material used for filling it up. The author finds that the tunnel was constructed by first driving a heading through the undisturbed ground under the embankment, which was much too large, then building the tunnel, after which the surrounding space was filled in by laborers, whose work, there being hardly any supervision, was very imperfectly executed.

The bursting of the reservoir along the line of culvert was not, however, the only source of complaint. It was stated by persons in the neighborhood that the whole reservoir leaked, and was doing damage to property below; they therefore sought to restrain the Town Council from again attempting to repair or fill the reservoir.

The repairs were finally placed in the hands of the author. It appeared to him that the subject should be divided under two heads. First, what to do with the reservoir proper, and secondly, what alteration to make in the culvert. The excavation for the reservoir was nowhere less than twenty-five feet deep into the solid ground, the

was all tested. The breaking-test was 650 pounds on $2\frac{1}{4}$ square inches; many of the briquettes, after being in water for a week, did not break under a strain of 1,000 pounds on the square inch.

Up to a height of 30 feet, as it was all in solid, no movement could be anticipated through the settling of material behind the concrete; but above this point, where the made embankment commenced, although it had been standing for three years, some slight settlement might be expected. For this reason the author considered it inadvisable to cover the upper portion of the embankment with such unyielding material as concrete, and therefore removed the pitching, and 2 feet of the embankment underneath, keeping the slope as before. The most clayey and suitable portion of this was selected for puddle, and a bed 1 foot thick was relaid, after having been cross-cut and watered slightly. On the top of this a layer of gravel was deposited and thoroughly punned, and over this a layer of pitching one foot deep, well blended with gravel.

The earth-work of the embankment outside the puddle-core is of a most untrustworthy nature, and the heavy tropical rains excavate holes in the sides and top which enlarge with great rapidity. The author therefore gave a slope at the top with a fall of 3 feet towards the outside, and built a drain near the top of the outside slope leading to two rough waste-water courses at the east and west ends of the northern embankment, and covered the whole of the summit of the embankment with a layer of 6 inches of gravel, which the rain soon consolidated. A wall 4 feet 6 inches high was also built round the east, west and north sides of the embankment, at the top of the inside slope.

The culvert was then uncovered to the top of the crown of the arch to ascertain the extent of the damage, and it was found that a space about 2 feet high existed along the outside of the arch. As the sides had suffered no damage, the trench was refilled with earth in 6-inch layers, which were each carefully punned as the work proceeded.

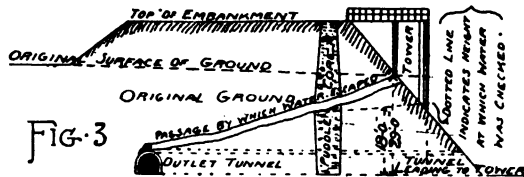
The tunnel from the angle to the former valve-house, with the pipes therein, was retained, a fresh portion extending 100 feet further being added, and terminating in a new

valve-house. The culvert was extended because the pipes in the old valve-house were 17 feet underground, and in case of fracture could only be approached with great difficulty.

From the angle to the inside of the reservoir the old culvert and the old valve-shaft were entirely removed, and a new culvert, encased in concrete, was built from the angle to the inside toe of the embankment, where it terminates in a brick tower.

Across the puddle-trench a large portion on each side of the reach was excavated, and a concrete wall, of an average thickness of 5 feet at the bottom and 3 feet at the top, was built to top-water level. A second cross concrete wall, about 4 feet thick, was constructed near the spot where the old valve-shaft stood; this extends to 30 feet from the floor of the reservoir, the concrete at the sides there resting on it, being well toothed on both sides into the embankment. All the earth-work on the inside and outside of the breach, which did not appear thoroughly solid, was cut down, and the earth-work carried to the top of the embankment simultaneously with the concrete walls in layers of 6 inches, each layer being properly punned.

At present water is supplied to this and the lower reservoirs by a number of springs on the side of Table Mountain.



The smaller springs fall off rapidly in fine weather. It is surprising what an amount of water is wasted during heavy rain; such an amount of dirt and vegetable matter is then brought down, especially at the commencement of the rainy season, that the water is rendered unfit for storage. Although the rainy season begins in April or May, the springs are never at their strongest until August and September, after which they gradually fall till March.

A number of bore-holes were made on the side of the mountain above the reservoir, varying from 50 to 90 feet in depth, in each of which water was found; but it gradually disappeared. The whole of the cliff debris at the base of Table Mountain resembles a sponge, which is constantly being supplied by water filtered through the sandstone.

The reconstruction of the reservoir was carried out for \$187,000, and it was finished in eighteen months.

SEVENTEENTH ANNUAL REPORT ON THE COLUMBUS WATER-WORKS.

THE treasurer, Mr. Dudley A. Filler, reports the total cost of the works at \$753,064.85. Total receipts for the year from operation of the works, \$94,833.38; operating expenses and repairs, \$26,625.50. There were 393 meters and elevators in use, or a decrease of 56 from last year. The consumers have in these cases abandoned the use of meters rather than pay the cost of repairs.

Mr. A. H. McAlpine, Superintendent and Chief Engineer, reports the estimated population at 80,000, with about 25,000 using the water, there having been 464 new takers during the year. The distributing system consists of 69,100 miles of 4-inch to 24-inch pipe, 555 fire-hydrants, 539 line-valves, 486 elevator and hydrant valves, and 4,531 service connections. Additions for the year were 10,572 feet of pipe and 27 hydrants. There are two Holly quadruplex condensing engines of 4,000,000 gallons daily capacity each, and one Gaskill horizontal compound condensing engine of 10,000,000 capacity. Coal consumed for the year, 7,837,925 pounds. Average duty of the engines, based on an evaporation of ten to one, was 87,003,700. Daily average of water pumped, 5,208,107 gallons. Cost per million gallons, \$7.09, being a decrease from the previous year of 31.8 per cent. The greatest daily average pumped was 6,190,468 gallons during the month of January; the lowest was for November and was 4,712,434. The average water-pressure is 35 pounds, and the fire-pressure 115 pounds, the latter having been maintained for 67 hours without any accident.

The appendix contains the by-laws and regulations, a useful table showing the discharge from various sized ferrules at the average pressure, and the weights and sizes of pipes required.

Also a scale of meter-rates, with the maximum supply for various payments. Also a table of water-rates.

A NEW Board of Health will be organized in Morristown, N. J., as the present board is not legally constituted under the State law passed last spring.

NOTES ON ENGINEERING WORKS AT BOMBAY.

MR. KILLINGWORTH HEDGES, M. I. C. E., contributes some interesting notes on the engineering works at Bombay, India, to the *Engineer*, from which we abstract the following:

The Prince's Dock is being greatly extended, and is the most important work in the city; also there are several extensive engineering works in active progress in the neighborhood of Bombay. Of these, the new water-supply of the city, which is anticipated to deliver thirty-three million gallons daily, in addition to the present supply, is the most important, the waters having to be led in conduits and pipes a distance of 53½ miles from the artificial lake which is now being formed. Through the courtesy of the executive engineer, Mr. W. Clarke, the writer was given every facility of inspecting the whole of the work.

The magnificence of the new terminus of the Great Indian Peninsula Railway impresses the visitor to Bombay. In outward appearance there is some resemblance to the Caledonian station at Glasgow, except that the area covered by the Great Indian Peninsular terminus and offices is much larger, and after passing through the magnificent booking hall, with its vaulted roof and marble columns, one is surprised to find the platforms of the station cramped as to accommodation, and covered by a very low roof with very deficient lighting. The railway carriages are designed for coolness, having double roofs and sides; the gauge of the line, five feet six inches, admits of considerable interior room and ample accommodation for five persons to lie full length at night, the top berths folding up during the daytime; there is also a lavatory for each carriage, with an ample supply of water, and in some cases a shower-bath. In fact, the long journeys which passengers have to take in India necessitate sleeping accommodation to be afforded without extra charge. On the Great Indian Peninsula Railway there are three classes, a proportional charge per mile being made, so that first-class is 12 pies, or about 1¼d. per mile; twice the amount of second, and four times the price of third-class; the exact fare is always marked on the ticket, and for the third-class both in English and Persian figures; the latter class is doubtless the paying factor of Indian railways. Unimpeded with luggage, the natives throng at every station, taking up positions on the platforms hours before the departure of the train, and complacently squatting until the arrival of the next train, if, as it frequently happens, there is no room.

The workshops of the Great Indian Peninsular Company, are situated at Parell, a small station about five miles out of Bombay.

Repair work is only carried on in the locomotive department, but the carriages and wagons are constructed at Parell. Teak wood is exclusively used for the bodies, the frames being made of iron, which is also extensively employed for the covered goods wagons, the sides and roof being made of iron plates fastened to a wooden frame. There are 3,000 men in the locomotive and 2,000 in the carriage department, who are all natives, the European staff consisting of fifty who are foremen or draughtsmen. It is curious to see how the various trades are exclusively taken up by certain classes; thus the fitters are all Parsees, the carpenters mostly Jews, the tinsmiths Mohometans, and the copper-smiths and blacksmiths are all Hindoos. Indian railway traveling is slow, a great deal of time being lost at stations by reason of the apparent helplessness of the natives in getting in and out of the carriages; there is much, however, to interest the engineer. At one station we see large quantities of old pot sleepers discarded for the more practical Vignoles rail; at another, in order to save a turntable, two lines run off so as to form an inverted A, the locomotive running up one siding and back on to the main line by the other. A temporary road has been made from Atgaon station to Tansa; a continuous string of country bullock carts being met during the seven miles of drive; these carts are owned by the contractors for the dam works, Messrs. Glover & Co., and fetch the lime from the station. The method of driving the bullocks is primitive, and simply consists of screwing their tails, the driver sitting on the pole with a tail in each hand. The animals seem little worse for this treatment, but many die in the dry season, therefore bullock transport is not so cheap as is generally imagined.

The limit of what is to be the artificial lake is marked out with stones painted red; these are worshiped by the natives, whether on account of the red color of the engineer's fetish I cannot say; but we were treated to the singular spectacle of a native praying and making offerings to what appeared to be a very ordinary bench mark. The area, at present occupied by a teak forest, which is to be flooded, is eight square miles; the catchment area, from which the rainfall will be collected, is over 52 square miles, from which every source of contamination will be removed. The water will be impounded by means of a dam across the River Tansa, which will be built to a height of 109 feet above the river-bed. The total length of the dam at top when finished will be 8,700 feet; and excavations for the foundations are being rapidly completed along the whole length. The ashlar work will be bonded on to the solid rock, which is only met with at a depth varying from 20 feet to 50 feet, on account of the trap formation, which, cropping up to the surface in places, is full of fissures. Some 4,000 men and women are at work on these foundations, the men either excavating the earth or drilling holes for blasting, the women taking away the spoil in baskets. With the exception of the tramway which brings stone from a quarry that has been opened up down the

river, all the labor of removing the spoil is performed by women, who are simply provided with shallow baskets which they balance on their heads. This method is nearly always practiced in India, and in the opinion of many engineers is far more efficient than barrows, trollies, or carts, and has the great merit of enabling any number of coolies to be set to work on a given spot, where it is desirable to move a large quantity of spoil. For instance, on the Jhansi section of the Indian Midland Railway I found Mr. Walter Merivale, the executive engineer, had concentrated about 700 men, women, and children in a small area consisting of a depression and a slightly rising ground which was immediately required for a store yard. The method adopted was as follows: Fifty or sixty men were told off with picks and large hoes to dig up the earth and fill the baskets. At the place where the earth was to be deposited stood six chuprassies, or foremen, with bags of tin tickets, and close to the work a responsible clerk sat with an assistant, having spread before him 50 rupees' worth of money in copper and small silver. The coolies, or cowrie wallahs, as they are termed, carry a basket-load of earth on their heads, and as they deposit it receive one or more tickets, according to the load and the fullness of their basket; half empty baskets are thrown down and not paid for, but they are generally full. As soon as a coolie has a few coppers' worth of tickets, he or she goes to the table and changes them for their value in money, and this constitutes the popularity of the system, as they can come and go as they like, and they can work fast or slow. The value of the tickets is arranged so that the coolies can earn about twenty per cent. more than their usual pay, which is for men about 3 annas to 4 annas a day, women 2½ annas, and children 1 anna to 1½ anna; this increase pays well, as a good deal more than a usual day's work is obtained. The excavation of the foundations of the dam necessitates a great deal of blasting, which is done by native labor. The powder is all made quite close to the work in a most primitive manner by a native who employs women to grind it in the ordinary flour mills which are found in every native hut. The proportion is as follows: Nitre, 2; sulphur, 2; and charcoal, 3, to which, after the paste has been dried and ground, a small portion of sharp sand is added. The cost on the ground is 16s. 6d. per cwt., and the efficiency is said to be equal to the ordinary imported powder, which would come to very much more.

In this and many other districts in India, limestone in the shape of small nodules, known as "kunkah," is found in large quantities; from it most excellent lime is made which is moderately hydraulic. The burning of the lime and the preparation of mortar is carried out at Tansa on a large scale. The extensive character of the Tansa works may be gathered from the amount of the contract for the dam alone, which is 30 lakhs of rupees, or, roughly, £300,000, the contract time for finishing the work being six years, but it will be probably finished in less. Payment to the contractor is made monthly on the engineer's certificate, and 50 per cent. advance is made on the value of materials on the ground. Of the total payment, 10 per cent. is deducted and reserved for contingencies, and a lakh of rupees has been deposited on commencement.

THE fourteenth annual report of the Board of Health of the city of New Haven for 1886 estimates the population at 80,000, which gives a death-rate of 17.4 per 1,000, 1,392 deaths having been reported. Dr. C. A. Lindsley, the Health Officer, embodies in his report a brief essay on filth and the diseases connected with its presence, and remarks that "the intelligence of tenants on sanitary questions is exerting an influence more potent than all the authority conferred on boards of health to bring landlords to a right way of thinking."

"If the people demand sanitary houses the landlords will provide such for them; but the time to make the demand is before they take a lease. It is a very injudicious method to move into a house first and then come to the Board of Health with complaints that the sinks and basins are untrapped or that an overflowing cesspool is running into the cellar. It is very much better to let the unwholesome houses stand empty." He goes on to say: "The plain statement of the situation is this. New Haven is not a model city from a sanitary point of view. The relation of your board to its sanitary condition is not just what it should be, and not what it is generally supposed to be. While in public estimation you are held more or less responsible for good sanitation within its limits, yet from a legal outlook you have very little authority to remove the evils which disturb the public health or to force the observance of those fundamental laws which you know so well are essential to its preservation. Your functions are limited to discovering the local influences which produce disease, enforcing the abatement of a few of those most offensive to the popular sense, and by slow and tedious stages instructing the people in the importance of the subject."

This applies well to most cities and to most boards of health in this country, nor can it well be otherwise under our form of Government.

The total expenses of the board for the year were \$7,119.81.

PAVEMENTS AND STREET RAILROADS.
No. XII.

(Continued from page 323.)

WOOD PAVEMENT IN THE METROPOLIS.*

THE expansion of wood is a question demanding consideration in carrying out such works. In unprepared blocks this is specially necessary, and in proportion to the width of the street so is it desirable to leave a space next the footways, varying from one inch to two inches in width. The actual condition of the wood and the state of the atmosphere at the time of laying exercise a material influence upon the width of the margins thus left. Another mode is by omitting to grout the channels for a week or longer period after the other portions have been completed; and another by paving nearly up to the kerb, and afterwards taking out the nearest course so soon as expansion sets up. In any case, it is necessary to temporarily fill up the margin with sand or other suitable material, which can be raked out from time to time until expansion ceases, which generally occurs in the course of twelve to eighteen months from completion. In the Chelsea works it was then found desirable to rake out the temporary filling, and where any space was left, to fill in with cement grout, the surface being carefully pointed in cement. This work effectually renders the channels impervious to water, and tends to prevent premature decay, and was executed at a cost equal to 0.86d. per square yard of pavement.

It frequently happens that, notwithstanding those provisions, and whether the blocks are plain or dipped, the outer portions of the footways become displaced during the period of expansion, but subsequent to the above-named period wood pavement generally maintains a fairly constant state. The author has never observed any contraction in wood pavement except during the severe frost in January, 1881, at which time, when 22° of frost were registered, several rather alarming cracks in a longitudinal direction appeared in the Sloane Street pavement, at places where the wood was especially exposed to the severity of the weather. Immediately the frost terminated the cracks appeared to close up naturally, and the pavement assumed its former sound condition.

This plain system of pavement was laid in Sloane Street and King's Road in 1879, and upon closely observing the effect of nearly five years' traffic upon it, the result is eminently satisfactory. The plain type of pavement had previously been adopted by Messrs. Mowlem & Co. in several parts of the metropolis, with the exception that their joint was wider and was formed of lime grout, and that their form and manner of studding were different, and the author ventures to assert that it comprises all the essentials of a sound pavement; a quiet and smooth surface for vehicles being provided, and the pavement being sufficiently close-jointed to insure a safe foothold for horses. Experience proves that the cement joint is reliable, that it adheres to the blocks, effectually resists wet, and does not unduly wear down below the surface of the wood, and thereby allow dirt to accumulate in the joints, neither does it permit displacement of the blocks; the author therefore feels that he may justly pronounce it successful, and claim for it another advantage as compared with the mastic-joint—viz., the absence of the annoyances which are created by asphalt kettles in streets during the execution of the works. Upon inspecting the numerous openings which have been made for gas and water services or drainage-works, the actual condition of the wood and foundation has invariably proved satisfactory; the surface of the concrete is hard and dry, the joints are sound, and the blocks as a rule present a fairly good surface, and are not found to contain an excessive amount of moisture.

The prime cost of the pavement in King's Road and Sloane Street amounted to 10s. 6d. per square yard, and the only repairs which have been found necessary consisted in the removal of some defective blocks during the past twelve months. The blocks were originally 5.87 inches deep, whereas their present average depth measures 5.22 inches in King's Road and 5.60 inches in Sloane Street. The probable life of the block may be taken at seven years for King's Road and eight years for Sloane Street. The annual vertical wear of wood is equal to 0.144 inch in King's Road and 0.065 inch in Sloane Street, and if reduced to a traffic standard of 750 tons per yard width daily, the following results are obtained—viz.:

King's Road.....	0.196 inch.
Sloane Street.....	0.175 "

Several other systems of pavement were laid in King's Road at the same time for the purpose of practically testing their respective merits. In one instance a layer of metallic lava asphalt one-half inch in thickness was laid upon the concrete foundation, the blocks being laid and jointed as already described. Opposite the Royal Military Asylum wall creosoted blocks were adopted, one length being formed with a semi-mastic joint—namely, the lower half bituminous mastic and the upper half lime grout—the other being entirely jointed with grout composed of lime and sand. The section of pitch-pine blocks previously described was also laid at this part, the joint consisting of Portland cement grout. The author has carefully examined the various experimental sections of pavement, the cost of which, together with the ascertained wear and other particulars, are as follows—viz.:

(a) *Plain deal blocks on layer of Asphalt*—The cost amounted to 12s. 4d. per square yard; the present depth of the blocks is 5¼ inches; the foundation is in a perfect

condition, and the blocks are fairly good. The estimated life of the pavement is seven years, the average annual wear being 0.139 inch.

(b) *Creosoted blocks, with mastic joint*—The cost was 14s. 2d. per square yard; the present depth of the blocks is 5¼ inches, and the foundation is perfectly sound. The lime grout part of the joint has perished and almost crumbled away, consequently a good deal of dirt has been pressed into the part above the bituminous portion, and the blocks came up very easily. The pavement may last for eight years, the average annual wear being 0.139 inch.

(c) *Creosoted blocks, lime joint*—The cost was 11s. 10d. per square yard; the blocks are 5¾ inches deep, and in a fairly good condition. The failure of the lime joint may possibly arise from a chemical action of the creosote; but it certainly has perished, and causes dirt to accumulate. The blocks will probably last eight years, the average annual wear being 0.111 inch.

(d) *Pitch-pine blocks*—This section costs 11s. 8d. per yard, and the present depth of the blocks is 5¾ inches. The foundation is dry and sound, and the cement-joint perfectly satisfactory. The repairs to the blocks have been very slight, and they will probably last eight or nine years, the average annual wear being 0.055 inch only.

If reduced to a traffic standard of 750 tons per yard width per day, the figures are: Pavement (a) 0.209 inch; (b) 0.240 inch; (c) 0.204 inch; (d) 0.088 inch.

Practically, the plain pitch-pine pavement is cheaper than yellow deal, and the ascertained vertical wear promises admirable results; but it does not appear that either of the other modes is attended with any particular advantage.

Other Pavements—In 1876, the Improved Wood Pavement Co. laid a short section in King's Road, near the Vestry Hall, in which planks were laid upon the concrete foundation, and "dipped" pitch-pine blocks were used; but in consequence of numerous complaints of the disagreeable rumbling and jarring noise which the rapid passage of vehicles over it caused, it was taken up and relaid without the boards after a period of seventeen months, an additional length being at the same time laid with "dipped" deal blocks. These pavements were subsequently particularly unfortunate, inasmuch as the "mastic" joint caused the surface to become uneven and bumpy, and rendered it necessary to execute frequent repairs, a considerable portion being relaid in 1882. Upon examination it transpired that the substance which formed the "mastic" joint had partially melted, presumably from the heat of the sun, and that the material had got underneath the blocks and forced them upwards. In November, 1883, the pitch-pine section was finally taken up, and the other portions were again repaired by the company for the same cause. Like results may be seen in other districts where a similar joint has been adopted.

The ascertained average depth of the pitch-pine blocks at the time of removal was 5¾ inches, the average annual wear during a period of seven years being 0.089 inch, or if reduced to the traffic standard, 0.119 inch. The deal blocks were measured and found to be 5 inches deep, the ascertained annual wear being 0.157 inch, and according to the traffic standard, 0.195 inch. With additional repairs, the latter may last another year, making their life seven years. The author further objects to this form of joint, because the melted asphalt adheres so tightly to the surface of the concrete that it is necessary to chip it off before new blocks can be laid, which process destroys the smooth surface of the concrete so considerably, that it necessitates a bedding of sand before new blocks can be properly laid. Further, the bitumen adheres so tightly to the blocks that to well cleanse them for reuse not only involves much labor, but is injurious to them, especially if they have borne two or three years' traffic, and the fibres have begun to spread. In the latter case they are not only unsound, but are also unfit to make neat or satisfactory work.

The Improved Wood Pavement Co., whose experience is probably greater than that of any other company, have laid their system in many of the leading streets, among which may be mentioned King William Street, Bishopsgate Street, Queen Victoria Street, Whitehall, Bond Street, Park Lane, and Old Brompton Road. In all instances where the patented system had originally been adopted, advantage was taken to modify and simplify it whenever it became necessary to renew the blocks. The company have entirely discontinued to lay a plank in the foundation, and now limit their system to the use of "dipped" blocks, laid with a semi-mastic joint upon a concrete foundation. For the purpose of comparison, the weight of the traffic being known, the following streets are referred to:

Ludgate Hill—Originally laid on boards in November, 1873, at a cost of 18s. per square yard. The terms of maintenance are, one year free, and fifteen years 1s. 6d. per square yard per annum. The blocks and plank foundation were taken up and new blocks laid on a concrete foundation and single board in 1877. The pavement was again taken up and laid with new blocks on the new principle—namely, without the intervening boards—in February, 1884, when the blocks were found to average 3 inches deep, their actual life being seven years. The author saw this pavement taken up, and was surprised to find how easily it was removed; the mastic joint had evidently lost its strength, and the result possibly points to the fact that its efficient durability does not extend beyond a limited period. The annual average wear of the last-mentioned wood was 0.428 inch, and if reduced to the traffic standard it was equal to 0.259 inch.

Aldersgate Street—Cost 15s. per square yard in September, 1874; the maintenance terms being two years free, and fifteen years at 1s. per square yard per annum. It was taken up and relaid on a concrete foundation in 1877, the blocks being merely reversed, and laid on lime mortar. In March, 1884, the blocks were renewed, the average depth then being 3½ inches; but in some parts the wood was only 2 inches thick. The annual wear was equal to 0.264 inch, and the actual life of many of the blocks was no less than nine and a half years. The blocks recently laid are 5 inches deep.

Northumberland Avenue—Paved in February, 1876, at a cost of 15s. per square yard, exclusive of the concrete foundation, which had been laid by the Metropolitan Board of Works. It is maintained by the company at a rate of 13s. per square yard for fifteen years. Baltic pine blocks, 6 inches deep, were laid on planks, and the approximate wear is 0.125 inch per annum. The surface is uneven, and shows considerable wear at the upper end, but its life will probably be nine years.

Leadenhall Street—In July, 1876, the western end was paved at a cost of 12s. 3d. per square yard, with two years' free maintenance, and fifteen years at 1s. per square yard per annum. The pavement was taken up, and 5-inch blocks laid in 1879, without the planks. The wood is considerably worn, and the surface is bumpy, probably from the mastic joint. The approximate wear of the wood is 0.200 inch per annum, which, reduced to the traffic standard, is equal to 0.186 inch per annum.

Piccadilly—An area of over 16,000 square yards was laid in April, 1876. In 1880 nearly two-thirds were renewed, and the boards taken out, the remainder done in February, 1882. Further repairs have been executed, and the surface shows considerable signs of wear. The author has been unable to obtain information as to the depth of blocks.

Knightsbridge—The portion east of Albert Gate was paved in April, 1878, the blocks being laid upon a single plank, and concrete foundation. The part west of Wilton Crescent was taken up in September, 1883, when the plank was removed, consequently the actual life of the wood was nearly five and a half years. The daily traffic is about 780 tons per yard width, or 250,000 tons per annum.

Parliament Street was paved in December, 1880, at a cost of 13s. 8d. per square yard, and the company maintained it for three years at an additional charge of 4d. per square yard per annum. The foundation is Portland cement concrete, 12 inches thick. The annual wear of the wood is 0.154 inch, and if reduced to the standard is equal to 0.104 inch.

Oxford Street, opposite Hereford Gardens, was originally laid on boards in November, 1874, at a cost of 16s. per square yard, with maintenance two years free and thirteen years 1s. per square yard per annum. In May, 1877, the boards were removed and new blocks laid, but they are now in a very bad condition, and are about to be taken up. Their life will have been seven years.

Henson's patent pavement has been practically tested, having been laid in Fleet Street, Oxford Street, Brompton Road, Euston Road, Uxbridge Road, and elsewhere. The theoretical principles of this system, which consists of a cement-concrete foundation, plain deal blocks on a felt bed, a close felt joint, and a dressing or grouting of boiling or prepared tar, and the merits of the felt bed and joint, were fully described in Mr. Howarth's paper, and the following particulars of ascertained wear may be useful in considering its merits.

Oxford Street, Princes Street to Marylebone Lane, was laid in November, 1875, at a cost of 16s. 6d. per square yard on existing concrete. The company offered to maintain it for fifteen years for 10s. per square yard, but the Marylebone Vestry arranged to do this work by their own staff. The pavement was repaired in 1879 and following years, the blocks being entirely renewed in September, 1883. Yellow deal blocks, 5 inches deep, were originally laid, and when taken up averaged 5½ inches thick, their actual life being 7.84 years. The annual average wear of wood was therefore 0.191 inch, which, if reduced to the traffic standard already described, gives 0.120 inch.

Oxford Street, Duke Street to Portman Street, was paved in October, 1876, at a cost of 14s. per square yard on existing concrete, the maintenance terms offered being 10s. per square yard for a period of twelve years. Six-inch blocks were laid, and they were repaired in 1880, 1881, 1882, and 1883, their present average depth being 3.60 inches. The surface of the wood is considerably worn, but upon recently inspecting an opening in the pavement, the foundation and joints were in excellent condition. The probable life of the blocks is eight years. The average annual wear of the wood is equal to 0.323 inch, and as reduced to the traffic standard 0.255 inch.

Oxford Street, Hereford Gardens to Edgware Road, was paved in December, 1875, at a cost of 16s. 6d. per square yard on existing concrete. The blocks were repaired each year from 1879 to July, 1883, when they were renewed. They were originally 6 inches deep, were worn to an average depth of 3½ inches, and had a life of 7.58 years. The probable life of the existing blocks is eight years. The annual average wear of the former wood was 0.329 inch, and as reduced to the traffic standard was equal to 0.250 inch.

Brompton Road—The eastern half was paved in December, 1878, at a cost of 12s. 9d. per square yard, with a free guarantee of three years. Since then frequent repairs have been executed by the Kensington Vestry. Six-inch blocks were laid, the present average depth of which is 4.94 inches. The surface is worn in places, and is bumpy and somewhat unpleasant to drive over. It is very dirty at the joints.

*A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

The probable life of the wood is six and a half years, the average annual wear being 0.184 inch, or according to the traffic standard 0.236 inch.

Fleet Street.—The western half was laid in September, 1877, at a cost of 16s. per square yard, the maintenance charge being 17s. per square yard for nineteen years. It has been repaired from time to time since 1881, and is now considerably worn and uneven. The probable life of the wood is seven years. The average annual wear of the wood is 0.269 inch, which according to the traffic standard is equal to 0.173 inch.

Leadenhall Street.—In August, 1876, the eastern half was paved at 18s. 6d. per square yard, the maintenance being two years free and seventeen years' annual maintenance at 8d. per square yard. The paving has been repaired on several occasions since 1880, and parts are now in a very bad condition, the wood having quite worn through in places. The paving is to be renewed this spring, after a duration of seven and a half years; and, taking the average depth of the blocks at 4 inches, the annual wear is equal to 0.264 inch, which reduced to the traffic standard is 0.198 inch.

Euston Road, Cleveland Street to Gower Street, was paved in November, 1880, at a cost of 11s. 6d. per square yard, with three years' free and twelve years' annual maintenance at 8d. per square yard. The pavement is in fairly good condition, only trifling repairs having been carried out, notwithstanding that the weight of the traffic per yard width is equal to 700 tons per day.

It must be apparent to any one who has carefully noticed Henson's pavement that there is a minimum of jarring, and consequently a very steady motion in driving over it when it is in good condition; yet experience seems to prove that after a few years' wear it is not in reality cleaner or less dusty than a plain close-jointed pavement, and a reference to Table V. in the appendix clearly shows that in durability it does not take the highest place.

The system adopted by the Asphaltic Wood Pavement Company consists in laying a ½-inch layer of asphalt upon the concrete foundation, upon which "dipped" blocks were placed, the lower part of the joint being of asphalt and the upper of Portland cement grout. This pavement has been laid in Fleet Street and other parts of the city, The Strand, Oxford Street, High Holborn, Hatton Garden, Brompton Road and elsewhere.

(TO BE CONTINUED.)

FALL MEETING OF NEW ENGLAND WATER-WORKS ASSOCIATION.

THE fall meeting of the New England Water-Works Association will occur on Wednesday, September 14, and will include an excursion to Lake Winnepesaukee.

In compliance with numerous requests the Executive Committee announces that one of the prominent features of this excursion will be the entertainment of the ladies who accompany members of the association, and members are urged to see to it that a large number of ladies are present.

Members and guests of the association will meet at the station of the Boston and Maine Railroad, Haymarket Square, Boston, on Wednesday, September 14, in season for train leaving at 8:30 A. M. The party will arrive at Alton Bay at 11:50 A. M. and at this point will take steamer "Mt. Washington" for Centre Harbor, touching at Wolfborough and Long Island. Returning the association will leave Centre Harbor at 1:45 P. M., Alton Bay at 4:45 P. M. Arrive in Boston at 8 P. M. The party will thus have a sail of four hours in which to enjoy the picturesque scenery of the lake region. Tickets, which will include dinner served on the boat, will be \$4 each, and may be obtained at the Boston station on the day of the excursion. Members are requested to occupy the special cars which will be assigned for the party. The tickets will allow those desiring it to remain at Centre Harbor or Wolfborough and return at a later day. If any considerable number desire to remain over at either Centre Harbor or Wolfborough, special hotel arrangements can probably be made. Those intending to remain should communicate at once with the Secretary. That ample provision may be made for the comfort of all it is highly important that the Secretary should know the exact number who will participate. Will you please mail a prompt reply.

A short business meeting will be held on the steamer, at which time all new applications for membership will be considered. Edwin Darling is President and R. C. P. Coggeshall, New Bedford, Mass., is Secretary.

THE Louisville *Courier-Journal* of the 29th ult. gives a lengthy account of the setting of some large columns in the new Government building in course of erection there. These are monoliths, 23 feet high, 2 feet 10 inches in diameter at the base, and 2 feet 4 inches at the top. The weight was about ten tons, and the stones were set by the use of a "breast" derrick. We notice the article to call attention to two points—the great size of the "lewis" used in lifting (about 17 inches long by 2 inches thick), and the method taken to insure contact between the lewis and the hole cut to receive it.

As to the length, we can hardly conceive it necessary. In sound granite a well-fitted lewis ¾-inch thick and 4 or 4½ inches long would certainly have lifted the columns. Of course in softer stone a greater length would be desirable. At the rear of the New York Anchorage of the East River Bridge a lewis, 12 inches long by 1½ inches thick, in limestone, bore several times this strain, and masses of

limestone of 10 to 11 tons were repeatedly hoisted by the 4½-inch lewis.

The method pursued at Louisville to insure contact was to pour sand into the hole after inserting the lewis, and is worthy of mention as a simple and effective expedient.

THE EFFECT OF SEA-WATER ON CONCRETE.

THOSE who use Portland cement concrete will be interested in the discovery to which the *Scotsman* drew attention recently. It appears that the Aberdeen harbor seaworks have suffered considerably. The concrete blocks have been seriously affected by the sea, and the authorities have been rather puzzled to account for its destructive action. Very great reliance has been hitherto placed by engineers and architects on Portland cement concrete; but this good opinion has been somewhat shaken, if all that we hear of certain hydraulic works can be substantiated. We take our information from recent accounts that have come to us. Indications of failure have been observed for some time in important sea-walls constructed of concrete, and the Aberdeen harbor works, if what we learn is true, confirm the misgivings which are entertained. The action of sea-water on concrete has been suspected of late years; but up to this time a satisfactory explanation of the damage sustained has not been given. Experiments have been recently made by direction of the Aberdeen authorities by Professor Brazier, of Aberdeen University, and Mr. William Smith, the harbor engineer. The decayed concrete has been ascribed to the force of the sea and wind, though the action was chiefly noticeable in the graving-dock in still water. The writer in the *Scotsman* says: "It is the action of the sea-water under pressure in still water that has rendered the nature of the damage in the present instance so conspicuous." The quay walls and breakwater were constructed fifteen years ago, the graving-dock two years ago, and in all these works a disintegration of the surface of the concrete by the chemical action of the salt water has been going on. The entrance walls are said to be built of Portland cement concrete, composed of one measure of cement, two measures of sand, and three measures of stones, with large rubble-stones incorporated in the walls. The wall surface is plastered with Portland cement mortar up to three feet of low water, the mortar being made of one measure of Portland cement and one of sand; the upper part of wall is faced with granite. During the process of emptying the water from the graving-dock, a hydraulic pressure varying with the tides of from 5 to 11 pounds per square inch is put on this concrete skin, the water forcing its way through pores of the skin, producing cracks and saturating the quay walls. The chemical action is hastened in proportion to the exposure, and is increased by the passage of water through the body of concrete. Various injuries are reported—e. g., the joints of the ashlar facing have opened in parts, owing to the loosening of the concrete surface beneath. The engineer consulted Professor Brazier. Test briquettes were prepared for analysis with a view of discovering the proportion of magnesia contained, and which was supposed to account for the damage. The Portland cement, it was found, had not contained more than one-half per cent. of magnesia, whereas the decayed concretes showed an increase in the quantity of hydrate of magnesia of 13½, 15, 22, and in one case as much as 40 per cent. This could only have been derived from the sea-water. Another deleterious substance found in the decayed concrete was carbonate of lime, which could hardly be traced in the Portland cement of the same standard. The concrete taken from the south breakwater showed it to have undergone a similar chemical change. The outer quay wall surrounding the side of the graving-dock were built of plastic concrete or Portland cement concrete, mixed in the usual way with a certain quantity of water, and allowed to set two to four hours, then broken up and deposited within frames under water in skips with opening bottoms, the concrete being left *in situ* in the frame. These walls do not show the same action or decay. Portions have been rebuilt with Roman cement concrete under water, but no decay has been noticed in them, and the only protection to the Portland cement concrete from the chemical action of the sea is apparently a non-porous lining or facing of stone-work.

Every care is said to have been taken in the concrete used; the cement had withstood the mechanical tests, and the concrete had set hard. The same failure of Portland cement concrete was noticed by Mr. Harrison Hayter, Vice-President of the Institution of Civil Engineers, two years ago. After a time the concrete expanded, vertical cracks of the material lifted some inches, and the surface cracked and flaked off. In every case a white "cream-like" substance was observed in the concrete, which Mr. Hayter had analyzed and was found to contain 80 per cent. of magnesia hydrate, consisting of about two-thirds magnesia oxide and one-third water. In every case of decayed concrete magnesia was present. Professor Brazier's experiments are confirmatory of the fact that these deposits of decayed cements contain magnesia, but he believes the substance comes from the action of the sea-water, and is not present in the Portland cement, as Mr. Hayter thought to be the case. We cannot enter into the details of the experiments made by Professor Brazier on the cement blocks, and the results he obtained by digesting some of the cement in sea-water, from which it appears that the amount of lime and magnesia contained in the sea-water in its original state is accounted for after the cement has been separated from the water, there being a gain of lime and a loss of magnesia amounting to nearly all the magnesia contained in the sea-water. Hence the same authority concludes that Portland cement cannot resist the action of sea-water.—*The Builder*.

ANNUAL REPORT OF THE BOARD OF PUBLIC WORKS OF ST. PAUL, MINN.

THIS report is based on those of L. W. Rundlett, Chief Engineer, and his assistants, A. Munster and George L. Wilson.

The board states that work done far exceeds that of any former year in the city's history, nearly equaling that of any two previous years.

One hundred and eleven sections of streets have been graded, with a total length of 42½ miles—an average cost of \$16,576.79 per mile, and a cost per foot of \$1.44.

Sections of seven streets and one alley have been paved, comprising 2½ miles.

Thirty thousand three hundred and fifty-one square yards of asphalt pavement have been laid at a cost of \$3.26, including 20 cents for grading and \$1 per lineal foot for curb.

Twenty-three thousand and seventy yards of cedar-block pavement have been laid at a cost per square yard (including cost of curb) of \$1.88.

Seventeen thousand four hundred and seventy square yards of pine-block pavement, with granite curb, at a cost of \$1.68. This pavement has been on steep grades where, in wet or frosty weather, it is stated that cedar blocks would have been too slippery. The specification require white pine blocks six inches deep, four inches wide, set on 2-inch plank foundations, and with rows separated three-quarters of an inch, the spaces being filled with paving cement and gravel.

The asphalt paving was laid by the Warren-Scharff Asphalt Paving Company on a concrete foundation under Washington specifications under a ten years' guarantee of all needed repairs without cost to the city, and a further guarantee for ten years at a price of one cent per square foot per year, fifteen per cent. of the contract price being withheld for a term of ten years.

Eleven miles of sewers have been constructed at a cost of \$269,117, three-fifths of the cost being assessed on property benefited.

Fifty-nine miles of wood sidewalk, costing \$85,831, and nine-tenths of a mile of stone sidewalk, costing \$23,064, were laid.

A large amount of sidewalks were also laid by individuals.

There were 35.64 miles of streets and alleys opened, widened, or extended, at a cost of \$585,413.

Grades were changed on twenty-five streets, at a cost of \$67,690.

The total cost of all improvements made during the year was \$2,009,806.

The Engineer's pay-rolls for the year amounted to \$36,000, and the pay of inspectors was \$20,200.

The board say truly: "These figures clearly demonstrate the fact that St. Paul is pushing its public improvements quite as rapidly as prudence and an economical administration of its affairs will justify."

A number of recommendations are made, of which we notice two:

First.—The suggestion that the letting of contracts may be authorized for the paving of two or more streets under one contract (or that two or more improvements may be made under one contract), where convenience or economy shall be subserved by so doing.

Second.—That as a measure of relief to property-holders, the time of redemption of property sold to pay assessments shall be extended to five years, the interest charges reduced, and that payments by installments be authorized.

The City Engineer makes the statement that "the value of abutting property is very much increased by reducing the grades on important avenues to a maximum of five per cent., even at considerable expense." In Washington a 4½ per cent. maximum has been recommended.

On the subject of telegraph wires he recommends that all poles in the business district be 60 feet high, the two top cross-arms to be reserved for city use free of charge; all poles to be absolutely under control of the city, with power to remove any wires after 24 hours' notice should the lines not be kept in proper order.

There are now 1,003 street monuments located and recorded, of which two hundred were set last year.

The total rainfall for the year was 21.89 inches, the average for 16 years being 27.81. The extremes of the thermometer in 16 years have been -39, December 25, 1879, and +100, July 1, 1883. The cost per mile for street sweeping has been \$12.77 in the upper district and \$7.97 in the lower, the streets being mostly 40 feet wide.

The Robert Street iron bridge, 1,541 feet long, with roadway 32 feet wide, and two sidewalks each 10 feet wide, has been completed at a cost for substructure of \$126,998.98; superstructure, \$191,512.01; total, \$318,510.99.



FALL OF AN ELEVATOR IN A DRY-GOODS HOUSE IN NEW YORK.

On Thursday, the 18th of August, at about 7:45 A. M., an elevator in the dry-goods house of G. Sidenberg & Company, at 49 Mercer Street, New York City, fell, having on board about thirteen persons; all but

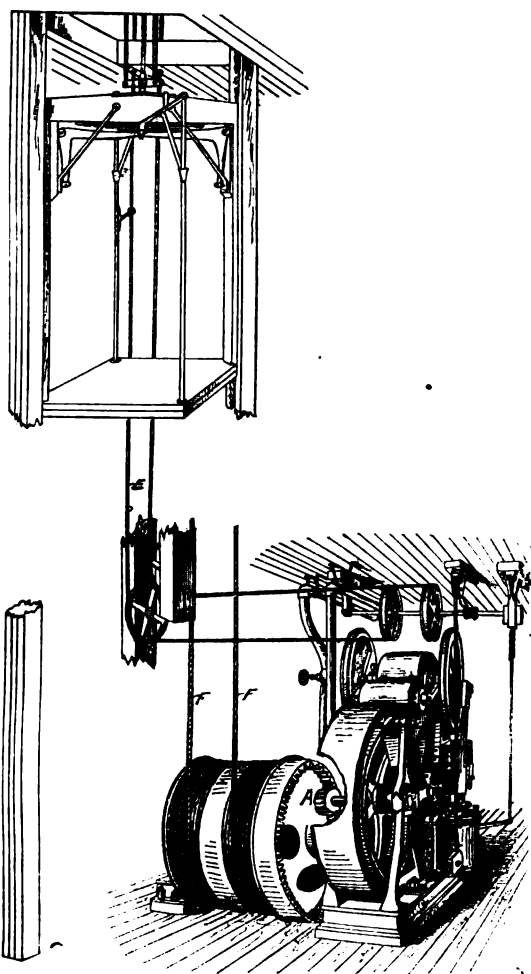
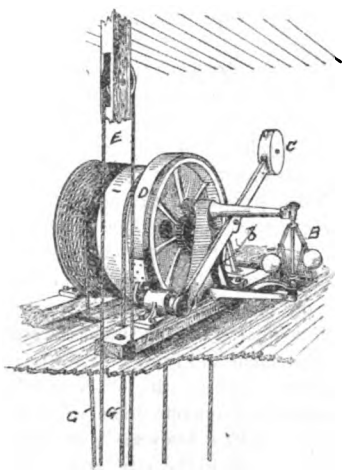


FIG. 1.

the man who operated the car being female operatives going to the work-rooms in the upper stories. One woman was instantly killed and the man who operated the car was seriously, if not mortally, injured, by having his spine dislocated, while all the other passengers sustained injury to the ankles and more or less serious shock to the system. The elevator had reached a height estimated at forty feet when it was stopped at a landing. Simultaneously with the working of the hand-ropes the car began to fall with all on board, and though it did not obtain a velocity equal to a fall through a height of forty feet, it struck the ground with sufficient force to cause the injuries above

mentioned. The elevator is of a type of Otis Bros. & Co.'s make, now considered old as compared with hydraulic elevators, and this one was fifteen years in use. Still there are many of the same kind in use in hotels and stores as passenger-elevators (though this one was principally used as a freight-elevator), as it is of the type of steam passenger-elevators that was considered first-class before the introduction of the hydraulic elevator.

The defect was one that human foresight could scarcely guard against, as a cursory and even minute examination might not detect it unless it was suspected. We, therefore, have gone to the trouble and expense of illustrating the elevator entire, and we also show in detail the defective pinion-wheel, the splitting of which caused the accident, in order that architects, engineers, and inspectors of elevator plants may be thoroughly conversant with the cause of this accident, and thus be the better able to guard against a similar accident in the future; as any spur gear machine, no matter by whom made, is subject to the same danger.

Figure 1 shows the engine on the basement floor. It is a double stationary cylinder machine, with belt and idler which gives motion to the shaft on which the broken pinion was keyed. The pinion engages the winding drum on the inside, the principal reason for an inside gear being to prevent the cables from getting cut by the gears, as often happened with older machines. A second winding drum is used at the top of the house as shown, and the two drums are connected by a cable—in some cases by double cables. When the elevator car is down, the cable from the lower drum is wound on the upper drum and the cable of the upper drum is unwound by the car. When the engine starts it winds the lower drum, which in turn winds the upper drum by unwinding the cables F, F therefrom, at the same time the upper drum is winding up the car and the cables G G.

The safety apparatus are two-fold. First, there are the usual ratchet and dogs on the guide-posts. These save the car if the cables break between the upper drum and the car, but are not sufficient to catch the car if the cables break between the upper drum or sheave and the lower winding drum, as the pull of the unbroken part of the cables will not let the springs throw the catches into place; hence the second or upper drum. The second safety-device, therefore, is on the upper drum in the form of a safety-brake that is thrown into use by the centrifugal action of governor balls, shown at the top in Fig. 1. This governor

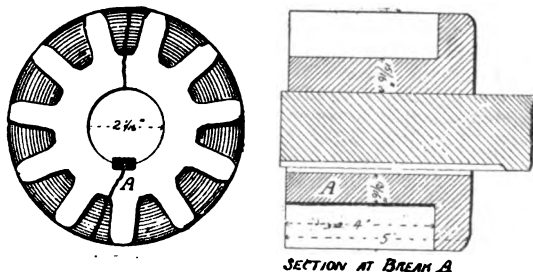


FIG. 2.

(B) is set for some particular speed, say 200 feet per minute, and should the engine run away, or the cables between the two drums break, or an accident such as occurred August 18 happen, the governor is supposed to trip the trigger-catch at *b* and throw on the brake D. In this case it is claimed the brake did trip, but that it did not hold. Whether the brake did or did not trip is not clear, but it is evident that the car came down with too much speed; though the presumption is the brake did catch, but with the load carried it was not sufficient to check the car after it had fallen some distance. It probably, however, prevented a more serious disaster, as had the car struck the ground after falling forty feet the theoretical speed would be fifty feet per second or 3,000 feet per minute. The unwinding of the cables from the drums, however, and other friction would have lessened this, but in any case the speed would have been enormous and sufficient to have killed nearly all in the car.

Figure 2 shows the pinion-wheel that split, with the line of fracture. It was of cast iron, 5 inches long and 6½ inches in diameter, with 11 teeth. The teeth were 4 inches long, as a stiffening flange ran around one edge of them. The nut was ⅞ of an inch thick in its thickest part and ⅜ in the key-way. It is supposed that it was keyed too tightly and split, as oil had worked into the fracture at A. The pinion was cast into shape and not milled out, which is impracticable in such small wheels with an end flange.

We presume "cast" cast steel would make a safer pinion than cast iron for such places, and even brass would be safer, though it would not wear so long.

It is but justice to the manufacturers to state that the elevator was fifteen years in use and that it had never been inspected by them, and as it was not registered at the Building Department as a passenger-elevator, it was not inspected by the Department Inspector, which inspection is made about every three months in the case of passenger-elevators in New York City.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
August 20.....	23.17	20.97	22.66	28.37	25.13	22.26	29.10

E. G. LOVE, Ph.D., Gas Examiner.

AN interesting gas case was recently decided in one of the London Police Courts. It appears that the Wandsworth and Putney Gas Co. brought action against a consumer to recover something over £12 for gas alleged to have been consumed from Christmas, 1886, to Lady Day, 1887. During the four preceding quarters the largest bill was £7 16s., and the consumer tendered £8 in payment of the bill in question, which, however, was refused by the company. The meter was found to be correct by a Government inspector. The defendant and his family all swore that, if anything, less gas had been burned than during the quarter preceding. The Justice, however, ordered the defendant to pay £8, but awarded him £8 costs. It is not likely the company will drop the matter here.

MR. G. R. HISLOP, in a paper read before the North British Association of Gas Managers on the "Gratuitous Supply of Burners by Gas Companies and Corporations," maintained that it was the "duty of every gas company and corporation to bridge over all deficiencies in science or general information on the part of their consumers, and supply them with the means of economically consuming the gas they deliver. In every department of trade or commercial enterprise, the producer is careful to show up to his patrons the special features, capabilities, or superiority, it may be, of his over all other competitive productions, in order that with such knowledge the value of the products may be enhanced." His plan is to determine the pressure throughout a given district and to supply burners capable of passing the required amount under the varying pressures, account being taken of the candle-power of the gas, and a suitable allowance made for loss of pressure after entering the consumer's premises.

A NEW YORK CITY syndicate, of which J. R. Bothwell is a member, is negotiating for the purchase of the works of the Halifax, N. S., Gas Company. The directors of the company favor the sale.

LEARNING A TRADE.

THE *Jewelers' Journal* argues—we think wisely—in favor of boys learning a trade in the shop. It says:

"When a boy has once gained the practical knowledge which every boy of the least ability will naturally acquire in a shop he is fitted to convert the knowledge which a college or university course offers him into useful wisdom."

The greatest fallacy of modern educationalists is that a boy can better be taught to do something by theory than he can learn to do something by practice. This has never proved true, and there is no reason to believe that it ever will. There are thousands of college graduates in this country to-day whose prospects of getting a living are extremely precarious, because they know nothing except what they were taught at college. On the other hand, there are a great many who have had their ideas broadened by a college course, and are correspondingly benefited thereby. Simple as the whole matter is, there are many who cannot be made to see it, and they are helped along sometimes, in their blindness, by those who ought to know better. The idea that a college course alone will fit a man to get a decent living is as fallacious as the idea that such a course cannot be made to help him in getting along in the world. The best advice, in our opinion, that can be given boys in this respect is: Do not depend upon what you may acquire at some institution of learning to get you comfortably through the world. The failures will be a hundred to one. On the contrary, do not despise what you may learn at schools and colleges. This will be a mistake, though not so fatal as the one first named.—*American Machinist.*

THE International Association of Plumbers, Gas-Fitters, and Steam-Fitters of the United States and Canada will hold its next meeting, September 5, at Fraternity Hall in Milwaukee.

REVISION OF THE NEW YORK PLUMBING RULES.

WE print below the revision of the plumbing rules, which has just been completed and adopted by the New York Board of Health. We have indicated by italics those portions in which the principal changes have been made. The important ones are: The definition of the time within which, after the filing of plans, work must be begun or new plans be filed. Under the regulation now adopted, if work is not begun within six months, the approval of the board must be again obtained. This provision is, no doubt, a safeguard against a fraudulent change of plan after it has passed the board, which would be resorted to by some skin builders. Another change is in the more stringent regulation of the laying of the house-sewer from the street to the house-wall. The board now reserves the right to compel the laying of an extra heavy iron pipe in cases where the ground is filled in, in place of ordinary iron pipe. School-sinks or privy-sinks of the sort now used are not recognized. The use of modified forms will be passed upon as occasion arises. When there are no sewers it is permitted to use a water-tight cesspool. As a concession to the views of the President of the Board of Health, the rules now explicitly give to the board authority to omit the trap from the main house-drain. Further than this Mr. Bayles and the Board of Health did not care to go. The location of the air-inlet from inside the trap is now more strictly defined. Perhaps the most important change is found in the requirement that "extra heavy" iron pipe must be used in all cases. Hitherto, the board has only required its use in certain conditions. Tarring of iron pipe is prohibited.

These are the changes of widest bearing, but if the italicized portions of the rules be studied it will be found that there are many amendments in the direction of a more stringent enforcement of the purport of the Plumbing Law of 1881. Five years' experience and the support of the plumbers and the community have emboldened the board to go several steps beyond the earlier rules.

The rules were formulated after obtaining the views of a Special Committee of the New York Master Plumbers' Association.

RULES AND REGULATIONS.

I.

THE REGISTRATION OF PLUMBERS.

Rule 1. Every plumber engaged in business in the city of New York shall appear in person at the Health Department, No. 301 Mott Street, and register his name and address, pursuant to the provisions of chapter 450, Laws of 1881, upon the forms prescribed by the Health Department.

Rule 2. It shall be the duty of every plumber to give immediate notice of any change in residence or place of business, for the correction of the Register.

Rule 3. The list of registered plumbers shall be published in January of each year.

II.

OF PLUMBING.

The law requires that the plumbing and drainage of all buildings, public and private, shall be executed in accordance with plans and specifications previously approved in writing by the Board of Health; and that suitable drawings and descriptions of the said plumbing and drainage shall, in each case, be submitted and placed on file in the Health Department.

Plans of plumbing work filed with this Board for approval shall state within what time the work therein described will be begun. If it is not begun under approved plans within the time thereon specified, such plans must again be presented to the Board for reconsideration. Plans are approved upon the condition that such approval expires by its own limitation within six months from date of permit, unless work under it is then in progress.

Drawings and descriptions of the plumbing and drainage of buildings erected prior to the passage of the act of 1881 may be placed on file in the Health Department.

Blank specifications for plumbing and drainage will be furnished to architects and others, on application at this office.

As the law requires that the plumbing and drainage be executed according to a plan approved by the Board of Health, no part of the work shall be covered or concealed in any way until after it has been examined by an inspector of the Board of Health; and notice must be sent to the board when the work is sufficiently advanced for such inspection.

III.

PLAN OF DRAINAGE AND PLUMBING APPROVED BY THE BOARD OF HEALTH.

The following plan of construction has been approved by the Board of Health. When the work is completed, and before it is covered from view, the board must be notified, that it may send an inspector.

1. All materials must be of good quality and free from defects; the work must be executed in a thorough and workmanlike manner.

2. The arrangement of soil and waste-pipes must be as direct as possible.

3. The drain, soil, and waste pipes and the traps must, if practicable, be exposed to view for ready inspection at all times, and for convenience in repairing. When necessarily placed within partitions or in recesses of walls, soil and waste pipes must be covered with wood-work so fastened with screws as to be readily removed. In no case shall they be absolutely inaccessible unless so placed in accordance with a permit issued by the Board of Health.

4. All interior water-closet compartments in tenement-houses shall be ventilated into air-shafts of not less than three square feet in area.

5. Where there is a sewer in the street every house or building must be separately and independently connected with it. When possible such connection must be made directly in front of the house.

6. Where the ground is made or filled in, the house-sewer, by which is meant the portion of the drain extending from the public sewer to the front wall, must be of extra heavy cast-iron pipe of such diameter as the Board of Health may approve. Such pipes should be laid with the joints properly calked with lead.

7. Where the soil consists of a natural bed of loam, sand, or rock, the house-sewer may be of hard, salt-glazed and cylindrical earthenware pipe, laid on a smooth bottom, free from all projections of rock and with the soil well rammed to prevent any settling of the pipe. Each section must be wetted before applying the cement, and the space between each hub and the small end of the next section must be completely and uniformly filled with the best hydraulic cement. Care must be taken to prevent any cement being forced into the drain to become an obstruction. No tempered-up cement shall be used. A straight-edge must be used inside the pipe, and the different sections must be laid in perfect line on the bottom and sides.

8. Where there is no sewer in the street, and it is necessary to construct a private sewer to connect with a sewer in an adjacent street or avenue, it must be laid outside of the curb, under the roadway of the street on which the houses front, and not through the yards or under the houses.

9. The house-drain must be of iron, with a fall of at least one-quarter inch to the foot.

10. Where water-closets discharge into it, the house-drain must be at least four inches in diameter.

11. It must be securely held in place against the cellar-wall or properly suspended from the cellar ceiling. It can be laid under the cellar floor only when a permit from the Board of Health has been obtained.

12. It must be laid in a straight line, if possible. All changes in direction must be made with curved pipes, and all connections with Y-branch pipes and one-sixteenth or one-eighth bends, if possible.

13. Any house-drain or house-sewer put in and covered without due notice to the Health Department, must be uncovered for inspection at the direction of the inspector. *Old sewers or house-drains can be used for new houses only when found by an Inspector of this Department to conform in all respects to the foregoing regulations governing new sewers and drains.*

14. Unless omitted by permission of the Board of Health, a running or half-S trap must be placed on the house-drain at an accessible point near the front of the house. This trap must be furnished with a hand-hole for convenience in cleaning, the cover of which must be properly fitted and made gas and air tight with some suitable cement properly applied.

15. When the trap described in Section 14 is required in the house-drain, there must be an inlet for fresh air to enter the drain just inside of the trap, of at least four inches in diameter, leading to the outer air and opening at some place shown on the approved plans, not less than ten feet from the nearest window. No cold air-box for a furnace shall be so placed that it can possibly draw air from this inlet-pipe.

16. No brick, sheet-metal, earthenware, or chimney flue shall be used as a sewer-ventilator, nor to ventilate any trap, drain, soil, or waste pipe.

17. Every vertical soil and main waste pipe must be of iron, and where it receives the discharge of fixtures on two or more floors, it must extend at least two feet above the highest part of the roof or coping or light-shaft louvers, and have a diameter above the roof at least one inch greater than that of the pipe proper; but in no case shall it be less than four inches in diameter above the roof. No cap or cowl shall be affixed to the top of such ventilation-pipe, but in tenement-houses a strong wire basket shall be provided, and securely fastened thereto in every case, to cover the mouth of it.

18. Soil, waste, and vent pipes in an extension must be extended above the roof of the main building when otherwise they would open within twenty feet of the windows of the main house or the adjoining house.

19. Horizontal soil and waste pipes are prohibited.

20. The least diameter of soil-pipe permitted is four inches. A vertical waste-pipe into which a line of kitchen-sinks discharges must be at least three inches in diameter if receiving the waste of five or more sinks, and shall have two-inch branches.

21. Where lead pipe is used to connect fixtures with vertical soil or waste pipes, or to connect traps with vertical vent-pipes, it must not be less than one-inch pipe.

22. There shall be no traps on main vertical soil or waste pipes.

23. All iron pipes must be sound, free from holes or cracks, and of the grade known in commerce as extra heavy. The following weights per lineal foot will be accepted as standards:

2 inches,	5 1/4 pounds per lineal foot.
3 "	9 1/2 "
4 "	13 "
5 "	17 "
6 "	20 "
8 "	27 "
10 "	33 1/2 "
12 "	45 "

24. All fittings used in connection with such pipe shall correspond with it in weight and quality. No tar-coated cast-iron pipe shall be used.

25. When required by an inspector from the Board of Health, plumbing-work must be tested with the pepper-mint-test or by other approved methods, such test to be made by the plumber in the presence of the inspector. Defective pipes discovered must be removed and replaced by sound pipes, and all defective joints made tight, and every part of the work in which defects are found be made to conform to these rules and regulations.

26. All joints in iron drain-pipes, soil-pipes, and waste-pipes must be so filled with oakum and lead and hand-calked as to make them gas-tight.

The amount of lead used to a calked joint shall be not less than twelve ounces to each inch diameter of the pipe so connected.

27. All connections of lead with iron pipes must be made with a brass sleeve or ferrule of the same size as the lead pipe, put in the hub of the branch of the iron pipe and calked with lead. The lead pipe must be attached to the ferrule by a wiped or overcast joint.

28. All connections of lead waste and vent pipes shall be made by means of wiped joints.

29. Every water-closet, urinal, sink, basin, wash-tray, bath, and every tub or set of tubs, and hyarant waste-pipe, must be separately and effectively trapped; except where a sink and wash-tubs immediately adjoin each other, in which case the waste-pipe from the tubs may be connected with the inlet side of the sink-trap. In such a case the tub waste-pipe is not required to be separately trapped. Urinal platforms, if connected to drain-pipes, must also be properly trapped.

30. Traps must be placed as near the fixtures as practicable, and in no case shall a trap be more than two feet from the fixture.

31. All waste-pipes from fixtures other than water-closets must be provided at the outlet of such fixtures with strong metallic strainers to exclude from such waste pipes all substances likely to obstruct them.

32. In no case shall the waste from a bath-tub or other fixture be connected with a water-closet trap.

33. Traps must be protected from syphonage, and the waste-pipe leading from them ventilated by a special air-pipe, in no case less than two inches in diameter for water-closet traps and one inch and a half for other traps. Except in private dwellings, the vertical vent pipes for traps of water-closets in buildings more than four stories in height must be at least three inches in diameter, with 2-inch branches to each trap, and for traps of other fixtures not less than two inches in diameter, with branches 1 1/2 inches in diameter, unless the trap is smaller, in which case the diameter of branch vent-pipe must be at least equal to the diameter of the trap. In all cases vertical vent-pipes must be of cast or wrought iron.

34. Vent-pipes must extend two feet above the highest part of the roof or coping, or light-shaft louvers, the extension to be not less than four inches in diameter, to avoid obstruction from frost, except in cases where the use of smaller pipes is permitted by the Board of Health. They may be combined by branching together those which serve several traps. These air-pipes must always have a continuous slope to avoid collecting water by condensation.

35. No trap-vent pipe shall be used as a waste or soil pipe.

36. Overflow-pipes from fixtures must, in each case, be connected on the inlet side of the trap.

37. Every safe under a wash-basin, bath, urinal, water-closet or other fixture must be drained by a special pipe not directly connected with any soil-pipe, waste-pipe, drain or sewer, but discharging into an open sink, upon the cellar floor, or outside of the house. The outlets of such pipes should be covered by flap-valves.

38. The drain-pipe from refrigerators shall not be directly connected with the soil or waste pipe, or with the drain or sewer, or discharge upon the ground; it should discharge into an open and water-supplied sink. Such waste-pipes should be so arranged as to admit of frequent flushing, and should be as short as possible, and disconnected from the refrigerator. In tenement-houses it must be ventilated above the roof. Covering the outlet by means of a flap-valve is recommended.

39. The sediment-pipe from kitchen-boilers must be connected on the inlet-side of the sink-trap.

40. Water-closets must never be placed in an unventilated room or compartment. In every case the compartment must be open to the outer air or be ventilated by means of a shaft or air-duct. All water-closets within the house must be supplied with water from special tanks or cisterns, the water of

which is not used for any other purpose. Interior water-closets must never be supplied directly from the Croton supply-pipes. Except in tenement-houses, a group of closets may be supplied from one tank, but water-closets on different floors are not permitted to be flushed from one tank. In tenement-houses there must be a separate cistern for each water-closet, and one water-closet must be provided for each two families.

41. The overflow-pipes from water-closet cisterns may discharge into an open sink or where its discharge will attract attention and indicate that waste of water is occurring, but not into the soil or waste-pipe, nor into the drain or sewer. When the pressure of the Croton is not sufficient to supply these cisterns adequate pumps must be provided.

42. The valves of cisterns must be so fitted and adjusted as to prevent wasting of water, especially where cisterns are supplied from a tank on the roof.

43. Water-closets, when placed in the yard, must be so arranged as to be conveniently and adequately flushed, and their water-supply pipes and traps must be protected from freezing.

The compartments for such water-closets must be ventilated by means of slatted openings in the doors and roof.

44. No privy-vault or cesspool for sewage will be permitted in any part of the city where water-closets can be connected with a public sewer in the street.

45. Tanks for drinking-water are objectionable, but if indispensable they must never be lined with lead, galvanized iron, or zinc. They should be constructed of iron, or wood lined with tinned or planished copper, or wood alone. The overflow should discharge upon the roof, or be trapped and discharge into an open sink, but never into any soil or waste pipe or water-closet tank, nor into the drain or sewer. Discharge-pipes from such tanks must not deliver into any sewer-connected soil or waste pipe.

46. Rain-water leaders must never be used as soil, waste, or vent pipes; nor shall any soil, waste, or vent pipe be used as a leader.

47. When within the house, the leader must be of cast iron, with leaded joints, or of copper, with soldered joints. When outside of the house and connected with the house-drain it must, if of sheet metal with slip joints, be trapped beneath the ground or just inside of the wall, the trap being arranged so as to prevent freezing. In every case where a leader opens near a window or a light-shaft, it must be properly trapped at its base. The joint between a cast-iron leader and the roof must be made gas and water tight by means of a brass ferrule and lead or copper pipe, properly connected.

48. No steam exhaust, blow-off or drip pipe shall connect with the sewer or with any house-drain, soil-pipe or waste-pipe. Such pipes must discharge into a tank or condenser from which a suitable outlet to the house-sewer may be provided.

49. Cellars should not be connected to the house-drain unless necessary. Dry cesspools should be used where practicable. Mason's traps for yards, cellar and area drains are prohibited.

50. Subsoil drains must be provided when necessary. When used they must be effectively trapped and means provided to maintain a seal.

51. Yards and areas, and open light courts, must always be properly graded, cemented, flagged, or well paved, and properly drained; when the drain is connected with the house-drain it must be effectively trapped. Front area drains must, where practicable, be connected with the house-drain inside of the running trap, if one is used.

52. Cellar and foundation walls must, where possible, be rendered impervious to dampness, and the use of asphaltum or coal-tar pitch in addition to hydraulic cement is recommended for that purpose.

53. In no case will the general privy accommodation of a tenement or lodging house be allowed in the cellar or basement.

54. When there is no sewer in the street, and no way of reaching a sewer on an adjacent street or avenue, by any means provided for in these regulations, privy-vaults and cesspools will be permitted; but in all cases they shall be built and maintained absolutely water-tight. They shall be placed as far as practicable from any well, and so ventilated that no nuisance shall result therefrom.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A PROBLEM IN HOUSE DRAINAGE.

SCRANTON, PA., August 3, 1887.

SIR: Inclosed I send you a sketch (Fig. 1) of soil and ventilating pipes as are now in place in one of the best buildings in this city. There is a great defect in their operation, and it is proposed to remedy them by making alterations as set forth on sketch.

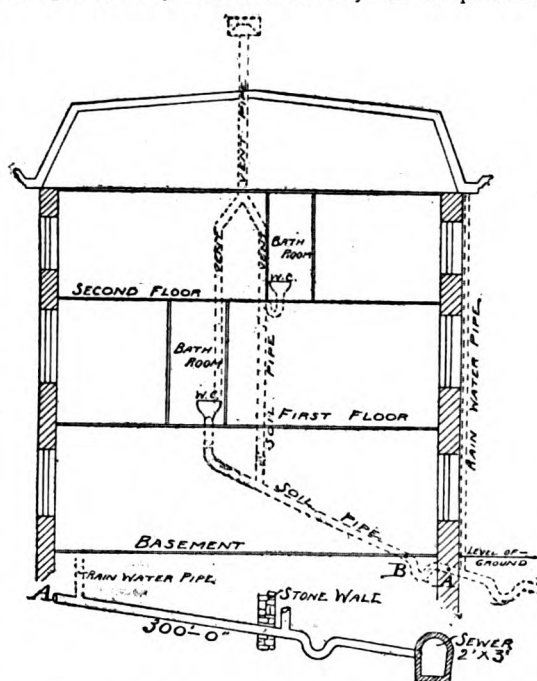
The dotted lines represent the pipe now in place and discharging into a cesspool about forty or fifty feet from the building. The lines at bottom of sketch represent proposed improvement by discharge into sewer 300 feet distant. One proposition is to commence at A, and putting the trap outside of garden wall, with a pipe from sewer to about two or four feet above ground, with a view of ventilating through rain-water pipe. The air-inlet pipe is shown outside of garden wall.

Another proposition is to begin at B and leave out one trap entirely, and put the other trap inside of garden wall, with a short pipe reaching above the surface of the ground between the trap and residence.

As some change is necessary at once, all parties have agreed to submit the question to you, and we would like to have you answer as soon as possible. We are now making alterations in water-closets, and would be very much pleased if you would give the question your immediate attention. Respectfully yours, F. W. WATSON.

[On the data furnished we should advise placing the trap on house-drain near the house-wall with fresh-air inlet, as is the practice in New York, Boston, and other cities. As the character of house is not stated—i. e., whether with front wall near sidewalk as in New York, or a suburban house with piazzas—we cannot say whether the trap should be placed inside the house with fresh-air inlet from just outside the wall, or whether the trap should be located in an accessible brick vault just outside the house. If there is available room we should prefer the latter plan.

We should place no trap between the house-trap and the sewer, and if the public sewer had manhole ventilation near the point of proposed junction with this 300 feet of private drain, the necessary ventilation of this 300 feet of drain could be secured by connecting a leader pipe with this drain just beyond the main trap in the vault. This suggestion is made on the assumption that the public sewer is kept in reasonably good condition. The leader-pipe should then be of good material and air-tight in its joints, so as to carry the escape above



windows, either of your own house or the adjoining houses. If this cannot be done you will have to trap the leader by having it enter the drain on the house side of the main trap in the vault. Then secure what ventilation for the drain you can by placing a vent-pipe for the 300 feet of drain as near the vault as you can so as to avoid offense—i. e., between it and the junction with the public sewer. If this cannot be done, forego the ventilation of the drain.

Your soil-pipes should extend full size at least through the roof. You will also need a grease-trap to prevent stoppage in the long private drain from grease. You will see illustrated methods of arranging a main trap and fresh-air inlet in a brick vault in "House Drainage and Plumbing Problems," on pages 43, 45, and 47.]

HOW TO MAKE HARD WATER SOFT—COVERING FOR LEAD PIPES UNDERGROUND.

BEAR RIVER, ANNAPOLIS CO., N. S., }
July 29, 1887.

SIR: (1) I have a tank plastered with Portland cement and a brick partition across one end to serve as a filter. The water is hard and very dark colored. Is there any way it can be made soft and clear as spring-water? (2) What is the best covering for lead pipe that is to be buried underground? Respectfully yours, W. W. CLARKE.

[(1) The only method that is practicable by which to soften water on anything of a large scale is what is known as Thomas Clark's method. He was Professor of Chemistry in the University of Aberdeen and patented the method about forty-three years ago.

Buck, in his "Hygiene and Public Health," says: "The process is a strictly chemical one and may be explained as follows: Take fifty-six pounds of pure quicklime and expose it to moist carbonic acid and it will absorb forty-four pounds of the carbonic acid and unite chemically with it, forming 100 pounds of carbonate of lime. This carbonate of lime will not dissolve of itself to any extent in water, but in the presence of carbonic acid there is formed soluble bi-carbonate of lime, and the amount of carbonic acid necessary to convert 100 pounds of carbonate of lime into bi-carbonate is exactly equal to that which has already

combined in the 100 pounds of carbonate." He then says: "Suppose that we have proceeded in this way and have now over 144 pounds of bi-carbonate of lime dissolved in water. If then we slake fifty-six pounds of quicklime and add to the solution, this will combine with the forty-four pounds of extra carbonic acid and form 100 pounds more of carbonate of lime in addition to the original 100 pounds, which, being now robbed of the carbonic acid which kept it in solution, will separate from the solution as a white powder along with the newly-formed carbonate of lime."

"In the case of any given amount of water the amount of lime necessary may be determined by analysis, or it (the lime) may be run in until it is evident from certain simple chemical tests that enough had been added. The lime is used as strong lime-water or milk of lime. After the treatment the water is allowed to settle from twelve to twenty-four hours and drawn off from the sediment. If the water is colored by peaty matter a very appreciable discolorization is effected."

The Newark Filtering Co., the Crocker Filtering Co., the National Water Purifying Co., of this city, and the Albany Steam Trap Co., of Albany, N. Y., claim to have processes for filtering, clarifying, and aerating water for domestic use which can be easily applied to the treatment of any quantity of water with good effect and at moderate expense.

(2) Black asphaltum varnish is about the best paint we know of to apply to pipes before they go in the ground; but do not confound it with black paraffine varnish, as the latter is worthless for this purpose.]

PERSONAL.

SURGEON W. K. VAN REYPEN has been appointed Medical Inspector of the Navy.

A BOARD, consisting of Captain Brown, Medical Inspector Bradley, and Civil Engineer Endicott, has been appointed to prepare a plan for the improvement of the Naval Hospital Grounds at Portsmouth, Va., for which \$50,000 was appropriated by Congress at its last session.

MR. GEORGE A. ELLIS, C. E., was Chief Engineer to the Racine, Wis., Water Construction Company. The works were tested a few days since, and one of the engines named George A. Ellis after him.

DIRECTOR WAGNER and Chief Engineer Park, of the Bureau of Gas, Philadelphia, are making a trip of inspection to the gas-works of several cities to gain additional information to be used in enlarging the Philadelphia works.

DR. EDWARD GERMER, of Erie, Pa., died in that city August 22, aged fifty-six years. Dr. Germer was President of the Pennsylvania State Board of Health under Governor Pattison, and was at his death delegate-elect to the International Sanitary Congress, which meets in Vienna in September.

COLONEL J. B. CLOUGH, Assistant Chief Engineer of the Northern Pacific Railway, died in Helena, Mont., August 22.

ASSISTANT CONSTRUCTOR HOOVER, of the Brooklyn Navy Yard, has been ordered to Washington to take charge of the preparation of plans for one of the new war vessels.

CAPTAIN WALTER L. FISK has been ordered from West Point to Washington for duty in the office of the Chief of Engineers.

JEFFERSON BORDEN, President of the Fall River Iron-Works Company and the Fall River Gas Company, of Rhode Island, died August 22, aged eighty-six years. Mr. Borden had been actively connected with the manufacturing and railroad interests of Fall River since 1821.

REAR ADMIRAL THOMAS T. CRAVEN, U. S. N., died at Charlestown Navy Yard, August 23, aged eighty years. He entered the Navy in 1822 as midshipman, was a captain in 1861, and saw service at the Battle of New Orleans and on the Mississippi. He was made a Rear Admiral in 1866, and was in charge of the Mare Island Navy Yard.

W. G. PROVINES, for nine years City Engineer of Cheyenne, Wyo., has resigned, owing to pressure of private business.

MAJOR DAVID PORTER HEAP, U. S. Engineers, has, at his own request, been released from duty as Engineer Secretary to the Lighthouse Board, and been assigned to duty as Engineer of the Third and Fourth Lighthouse Districts.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

HAMILTON, ONT.—Plans and specifications, in competition, are asked for by the Hamilton Coffee Tavern Company. For the best plan a \$100 prize will be given, for the next best a \$50 prize. The plans and specifications are to be the property of the company. The company does not bind itself to adopt any of the plans, but if any are adopted the author may expect to be employed to superintend their execution. Plans will be received up to 15th September next, addressed to Alfred Powis, Secretary, 31 King Street, East, Hamilton, Ont. Each must be marked with some device or motto.

PROPOSALS.

NOTICE TO CONTRACTORS AND BUILDERS.

Sealed proposals will be received at the office of the Superintendent of Public Schools, Birmingham, Alabama, for the entire construction and completion of a school building to be erected in said city, until 12 o'clock noon of Tuesday, the eighteenth day of October, 1887, the building to be of brick, with stone trimmings, three stories high, containing fifteen school-rooms, and to be 108x76 feet.

Plans and specifications may be seen at the office of the Superintendent of Public Schools, Birmingham, Alabama, or at the office of the architect, S. J. Hall, 30 E. First Ave., Columbus, Ohio.

Bond to the amount of the contracting sum will be required. The Building Committee reserves the right to reject any and all bids.

A. O. LANE,
G. L. THOMAS,
W. J. RUSHTON,
Building Committee.

MASONRY of basement and area-walls of Post-Office, etc., at Springfield, O. Until September 10. Address Will. A. Freret, Supervising Architect of the Treasury, Washington, D. C.

IRON WORK, etc., for the Court-house at Dallas, Tex. Until September 14. Address Will. A. Freret, Supervising Architect of the Treasury, Washington, D. C.

JOINER-WORK, wood-flooring, marble mantles, roof-tiling, terra-cotta arching, plastering for Court-house at Leavenworth, Kan. Until September 16. Address Will. A. Freret, Supervising Architect of the Treasury, Washington, D. C.

HEATING AND VENTILATION of the E. Spencer Miller School, 432 1/2 Ogden Street, Philadelphia. Until September 2. Address H. W. Halliwell, Secretary of the Board of Public Education.

LAMP-POSTS AND GASOLINE FLUID needed by the city of Allegheny, Pa. Until September 2. Address James Brown, Comptroller.

COURT-HOUSE at Vandale, Cross County, Ark. Until September 5. Architect B. J. Bartlett, Little Rock. Address Thomas B. Smith, Commissioner of Public Buildings, Vandale.

BUILDING the court-house at Fort Scott, Kan., complete. Until September 17. Address Will. A. Freret, Supervising Architect of the Treasury, Washington, D. C.

REPAIRING heaters, painting, galvanizing, etc.; also, paving and furnishing iron gates for the Schuylkill Arsenal, Philadelphia. Until September 9. Address M. I. Ludington, Deputy Q. M. General, U. S. A., 1428 Arch Street, Philadelphia.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested, see also the "Proposal Column," pages 341-343-344.

WATER, SEWERAGE, ETC.

EAST JORDAN, MICH.—Our correspondent writes in regard to water-works: "In reply to your inquiries, I will say that the matter is still in the hands of a committee. I don't think that anything will be done this year."

MASON CITY, ILL.—Our correspondent writes: "Our city voted on the question of issuing bonds for a system of water-works August 22. Cannot say what the result was yet. If decided in favor of bonds, I will inform you in regard to same."

MEXIA, TEX.—Our correspondent writes: "Our city is now building a water-works system; contract, \$22,000. Will be completed in sixty or ninety days."

LODO, ILL.—A committee has been appointed to sink a well for a water-supply.

MARINETTE, WIS.—The American Water-Works and Guarantee Company, which last month obtained a franchise to construct water-works here, will begin work at once.

STAFFORD, KAN.—Our correspondent writes: "The arrangement for a stand-pipe system of water-works has been completed, and work will begin in ten days."

We will have four miles of main pipe and fifty-five hydrants. Works to be built by W. A. McCoy, of Fort Scott, Kan., and to be completed by January 1, 1888."

DULUTH, MINN.—Nine dams will be built to increase the water-power on the St. Louis River. New York capitalists are interested.

GARDEN CITY, KAN.—Work on the water-works is progressing rapidly. The stand-pipe is nearly completed. Address the City Engineer for particulars.

MEDICINE LODGE, KAN.—A city election went by a large majority in favor of raising \$15,000 to introduce water.

PLATTSBROUGH, NEB.—The profiles and grades for a system of sewerage has been completed.

GREENLEAF, KAN.—We have received word from our correspondent that "The National Water-Supply Company, of Cincinnati, by John A. Wagner's steam-excavating process of sinking wells, has put in a gang of 8 wells, and has pumped them at the rate of 700,000 gallons every 24 hours for six days and is to pump them for six more to conclude the test. The rest of the works will be let by contract. Bids will be opened September 6, work to be completed December 1. The supply is a fine soft water."

LOS ANGELES, CAL.—General Bouton and N. L. Wicks propose to use the underground water below the bed of Los Angeles River for a water-supply, and have applied to City Council for permission to proceed with the works.

LOS ANGELES, CAL.—The Simi Land and Water Company filed articles of incorporation August 11. Its object is to develop the tract known as the Simi Rancho. The directors are Dan McFarland, L. T. Garnsey, L. W. Luitweiler, D. T. Perkins, Charles Forrester, and T. W. T. Richards. Almost the whole of the capital stock, \$650,000, is subscribed.

RIVERSIDE, CAL.—Among the prospective improvements are the Rubidoux Hotel, to cost \$250,000, a piped water-system, a \$100,000 high-school building, a \$50,000 opera-house, a \$50,000 casino, \$25,000 for piped water to Arlington, and electric railways. These projects, amounting to over half a million dollars, are assured, and in addition thereto a system of electric-lights, gas-works, and a hotel, to cost an amount equal to or greater than the Rubidoux, will swell the total to nearly \$1,000,000.

LARAMIE CITY, WYO., will have water from artesian wells. Address the Wyoming Central Land and Improvement Company.

ABERDEEN, DAK.—A city election will be held September 6 to vote on bonding for \$60,000 to construct sewers.

WESTERLY, R. I.—The contract for the laying of the West Side extension to the Shunoc water system was awarded August 16 to Mr. Frank A. Snow, of Providence. The pipe has just been completed at McNeal's Foundry in Burlington, N. J., and will be shipped this week, and as soon as it arrives the work will begin and will probably occupy about six weeks. Fifteen hydrants will be set.

CAMDEN, N. J.—The Water Committee of Camden City Council has authorized the clerk to advertise for bids for filter for the city water-works, with a capacity for 6,000,000 gallons, and the estimated cost for each additional million gallons.

RACINE, WIS.—The water-works were tested August 13. The system is direct pressure and stand-pipe. There are almost thirty-four miles of pipe. Two Blake pumping-engines. The works were built by Turner, Clark & Rawson, of Boston, and are owned by the Racine Water Company.

CHATTANOOGA, TENN.—August 30 an election will be held on the question of raising funds for a sewerage system.

SAN DIEGO, CAL.—Incorporated is the San Luis Rey Flume Company to construct dams, reservoirs, and canals for irrigation and water-supply. A large area has already been bought. Judge George Peterborough, E. H. Barnes, Frank H. Cunningham, C. S. Morrill are incorporators.

MILWAUKEE, WIS.—Engineer Benzenberg asks the Council for \$3,000 to put in a temporary intake for the water-works at North Point to preclude the possibility of a shortage of water at any future time.

PIERCE CITY, NEB.—A franchise has been voted to J. Guinney to erect water-works. He will commence right away. The franchise runs twenty years.

CARSON, IOWA.—Our correspondent writes: "At a special election held on the 7th of July it was voted to issue bonds for the purpose of water-works; \$200,000 was the limit of the amount of bonds that the town could issue. As yet the city has failed to receive estimates that are within the limits of the amount to be expended."

JOLIET, ILL.—Our correspondent writes: "Expect to let contract for water-works about October 1 for 20 miles from 20-inch mains down to 8-inch; 100 4-way hydrants, pumps with 8 million capacity; water from artesian wells. Works to be completed October, 1888, and the city to own works."

PAWNEE CITY, NEB.—Our correspondent informs us: "An election has been ordered for September 12, 1887, for voting for \$28,500 bonds for water-works in this city. Plans and specifications by A. A. Richardson, of Lincoln, Neb."

MINONK, ILL.—Our correspondent writes in regard to water-works: "The Council has by ordinance bonded the city in the sum of \$10,000, to bear five per cent., bonds advertised to be sold August 25, 1887. Also specifications are now in hands of contractors, and we hope to let same very soon and, have the works pushed rapidly to completion."

MT. CLEMENS, MICH.—Our correspondent writes in regard to water-works: "We have organized under State statute as 'The Mt. Clemens Water-Supply Co.' The Council of the city has as yet taken no decided action as to the expediency of the city putting in the

works itself. Until they decide that it is inexpedient for city to construct the works, and that it is expedient to have works, our company can do nothing. Address S. P. Spier, of Eldredge & Spier."

VINTON, IA.—A well for water or gas will be sunk.

MARINETTE, WIS.—The American Water-Works and Guarantee Company will build a system of water-works here.

TOPEKA, KAN.—An ordinance has been passed by city council creating Sewer District No. 13, and providing for the building of a sewerage system in the district.

MONTCLAIR, N. J.—The supply well for the Montclair water-works, which is to be 55 feet deep, has now reached a depth of 27 feet. The contractors have begun to work a double force of men, so as to drive the well day and night until its completion. The works are being constructed by McNamee & Co. of Brooklyn, well-known as the water-works contractors, and the pumping engines, to be put in by Henry R. Worthington & Co. will supply a direct pressure upon the mains, until the contractor shall complete the reservoir on the summit of First Mountain.

LONG PINE, NEB., has voted to put in water-works.

FAIRBURG, NEB.—Turner, Clark & Rawson, of Boston, have made a proposition to put water-works in here.

DUNLAP, IOWA.—The cost of the water-works which are to be constructed here will be \$10,000.

SYCAMORE, ILL.—The water-works will be improved by the addition of a stand-pipe, 135 feet high, and new pumping machinery. The cost is estimated at \$20,000. Address proposals to Water Commissioners until August 31.

BROCKTON, MASS.—Mayor Whipple has sent a letter to the Board of Aldermen asking them to appoint a committee to consider ways and means and plans for sewerage. No action has yet been taken.

TAUNTON, MASS.—The experimental wells at the pumping-station are satisfactory, and the matter of adding others to give a daily supply of 1,000,000 gallons will be brought by the Water Commissioners to the attention of Council.

PHOENIX, N. Y.—A special election, August 19, went in favor of establishing water-works by 138 to 12.

ALTOONA, PA.—The Board of Water Commissioners have draughts of ordinances in preparation looking to large expenditures for water-mains and for the Kintanog Point Reservoir.

DAVID CITY, NEB.—On August 20 a city election went in favor of raising \$20,000 for water-works.

MARSHFIELD, WIS.—Common Council is receiving bids for a sewerage system.

DREVERSBURG, TENN.—A supply of water will be obtained from artesian wells.

YORK, ME.—Six-inch iron pipe, hydrants, and force-pump will be bought to give a better fire protection. The Sanford Electric-Lighting Co. is also making tenders to furnish a supply of water here.

BELLEVUE, MICH.—It is proposed to extend the water-works at a cost of \$18,000.

OID, MICH.—On August 30 the town will vote on the question of introducing water-works.

PATERSON, N. J.—Sewerage contractors should watch for developments in Council over the proposed building of a costly sewer through solid rock in Hamburg Avenue.

RALPH, N. C.—J. L. Ludlow, C. E., has been employed by the city to prepare plans and superintend the construction of sewers. Work will be begun on the surveys at once.

NATCHEZ, MISS.—The Water Company will begin work at once to lay the main to obtain water from the river.

GREENBUSH, N. Y.—Henry W. Brown has the contract for building the pumping-house for the Greenbush Water-Works.

TOPEKA, KAN.—At the opening of bids for constructing sewers, August 17, the contract for the brick sewers was let to C. J. Rosen, total price not computed, and for pipe sewers to Decker & Mullen, price not computed. Decker & Mullen were the lowest bidders on both.

WHITEHALL, N. Y.—The Water Company will erect a new building to cost \$38,500.

ALTOONA, PA.—The contract for laying a 15-inch terra cotta sewer on Fifth Avenue, between First and Twelfth Streets, was awarded to Kelly & Co. The entire length of the proposed sewer is 4,775 feet, and includes the putting in of six inlets and the making of 20 house-taps. The contract price is \$1.17 1/2 per foot. The contractors have further agreed to put down 1,000 feet of 18-inch at the lower end of the sewer instead of 15-inch pipe at the same price.

AUSTIN, MINN.—Messrs. Loweth & Curtis, of St. Paul, are the engineers in charge of the new water-works. The contract has been let for \$36,000 to the National Brass and Iron Works of Dubuque, Iowa. Four miles of cast-iron mains, two 1,000,000 gallons compound condensing engines, fifty hydrants, a brick boiler-house and stack, and steel boilers will be furnished. Work will begin at once.

PRINCETON, ILL.—Our correspondent writes: "Nothing definite has been done in regard to water-works. At last meeting of Council there was some talk about water-works, and a committee of three was appointed to consult about the matter and to report at next meeting what in their judgment should be done."

PAXTON, ILL.—Our correspondent writes: "We expect to erect water-works this fall; have published plan and specifications for bids, a copy of which I enclose."

PAXTON, ILL.—Proposals for water-works will be opened by the Committee, August 20. The works include a tower, 80 feet high and 26 feet in diameter,

with a tank on top to hold 2,000 barrels; mains, hydrants, and pumping engine with a capacity of 250 gallons a minute. Address J. P. Middlecoff, S. P. Buhanell, O. D. Sackett, A. S. Hopkins, Committee.

PANA, ILL.—A committee has been appointed, with the Mayor, H. N. Schuyler, as Chairman, to ascertain the probable cost of water-works and where to get water.

MANITOWOC, WIS.—Plans are being prepared preparatory to advertising for proposals for building water-works.

CHICAGO.—A certificate has been filed with the Secretary of State announcing the increase of the capital stock of the Chicago Tubular Well Company, and giving notice of the change of name to the Chicago Tubular Well Works.

HAMBURG, PA.—Inquiries are being made as to sources of water for this place. Address George S. Mayer, Secretary of the Hamburg Water and Gas Company.

FORT SCOTT, KAN.—Sewerage projectors should address the Clerk of Council, or City Engineer, with propositions looking to constructing a system of sewerage here.

BEAUMONT, TEX.—Our correspondent writes "The city has levied a tax for water-works purposes, and \$14,000 bonds has been printed, signed, and sealed, and are now waiting to dispose of bonds in denomination of \$100, each with 6 per cent. interest, payable semi-annually. When bonds are disposed of the work will commence. I enclose specifications: One Blake's improved duplex pump, with two 14-inch steam cylinders, two 10-inch water-cylinders, and 12-inch stroke. There will be about 75 feet of suction-pipe, with foot-valve 12 to 14 feet under low-tide water. The water-pipe to be of 300 pounds test to the square inch; and hydrants to be used are Mathews' patent fire-hydrants. There will be about 2,060 feet of 8-inch pipe with 7 hydrants; 1,100 feet 6-inch pipe with 3 hydrants; 1,365 feet 4-inch pipe with 7 hydrants. All pipe and fittings to be tested, before covering up, with reasonable amount of pressure over working pressure. One iron stand-pipe properly connected with 8-inch pipe, and cut-off valve in connection. Bidders will make their own specifications of stand-pipe."

HOLMESBURG, PA.—The contract for the stand-pipe of the new water-works has been given to S. A. Farmer, of the Harrisburg Stove and Boiler Works, at \$5,200. The Warren Foundry and Machine Company has the contract for pipe at \$17,000.

HOOSICK FALLS, N. Y.—A village election, August 22, voted to bond the town in \$35,000 for a sewerage system. Address the Village Trustees.

CAMDEN, N. J.—Work on the improvement of the water-service has just begun. The cost is estimated at \$100,000.

WEAVER, WIS., has just obtained a water-supply from wells for fire purposes.

FLUSHING, L. I., wants proposals for laying water-mains, until September 6.

CARTHAGE, N. Y.—Our correspondent writes: "The question of water-works is being discussed at present by our taxpayers, and it is likely that a proposition to supply this village with pure and wholesome water, taken from Pleasant Lake, Champion, about four miles distant, will be submitted by the Trustees to a vote of the taxpayers soon. The proposition comes from the Canastota Water Co. Enclosed you will find an article on the subject giving a more detailed statement."

The enclosed statement is here given: "The Board of Trustees of this village have not yet entered into a contract with the Canastota Water Co. for the putting in of water-works. From present indications, however, it is probable that a contract to supply Carthage with pure and wholesome water will be made with the above company in a few days. The proposition presented to the board provides that if, after analysis, Black River water is found as wholesome as that in Pleasant Lake it will be used. If not, then the water from the lake will be used. They further agree to complete the water-main on State Street to the old cemetery before October 20, with seven non-freezing hydrants. The cost to the village will be \$400 per year for these hydrants. The Public School, village offices, and firemen's hall are to be furnished with water free of expense, also two public drinking-fountains. The company binds itself to furnish private families with water as cheaply as it is furnished in any village the size of Carthage in the State. All the expense of construction is to be paid by the company, but the village reserves the right to purchase the works at the end of any five years at an appraised value made by persons agreed upon by both parties. In time of fire the village controls the hydrants."

TORONTO, ONT.—The Water Committee has recommended to City Council the laying of a conduit across the Bay, at a cost of \$240,000.

IDAHO SPRINGS, COL.—Our correspondent writes: "We have a very fine system of water-works. We are building a new reservoir for the purpose of having a larger storage capacity; also, so that we can draw off our old reservoir and make some repairs on it."

READING, PA.—Our correspondent writes in regard to a filtering plant for the water-works: "Our Water Department has taken no action towards filtration, except to visit the Hyatt plant at Somerville, N. J. Several filtering companies have submitted propositions, but the matter has taken no definite shape as yet, and it is likely nothing will be done this year."

SPRINGFIELD, ILL.—Our correspondent writes: "There is not anything being done here now in regard to water-works. They have dug a big well near the River 'n-gamon to have filtered water, but it did not prove a success, and so all work is stopped at present, and I cannot say when they will resume work."

EAST HAMPTON, MASS.—Our correspondent writes in reference to reports from this place that nothing is being done about having water-works at present.

SAULT STE. MARIE, MICH.—A special town election has been voted in favor of raising \$10,000 for water-works.

BEACHTON, MASS.—An earnest discussion is going on here over sewerage. Address C. S. March, President of the Bechtown Improvement Society, for particulars.

WATER-PIPE.—About 170 tons of cast-iron water-pipe and special castings (4, 6, 8, 10 and 12 inch pipe), for the Rochester, N. Y., Water-Works. Until August 29. Thomas J. Neville, Clerk of the Executive Board, Rochester, N. Y.

TRENTON, N. J.—Hydrant manufacturers should note that the Chief Engineer of the Fire Department is making an inspection to decide how many additional fire-hydrants shall be erected.

HENDERSON, KY.—The Water-Works Commissioners have been authorized by the City Council to put in another pit and auxiliary pump. The pump will be a duplex, with a capacity of one million gallons in 24 hours. The cost of these additions will be about \$8,000.

LOUISVILLE, KY.—The Louisville Water Company are about to make extensive improvements.

BRIDGEPORT, CONN.—On September 3 Common Council will have hearings on the construction of several new sewers. Address the City Clerk.

TUSTIN, CAL.—Willard Bros. are prepared to supply water from their wells to the city.

SALT LAKE CITY.—City Council has awarded a contract to W. G. Childs for the construction of a new reservoir for the water-supply.

The Shields engine which is to be removed from the Cincinnati Water-Works was built in 1846. It is estimated that it has pumped 55,000,000,000 gallons of water.

GAS. STEAM. BUILDINGS. ETC.

ERIE, PA.—The project to test the natural-gas resources of the shore of Lake Erie has come to a head under the Presque Isle Natural-Gas Company. Twelve thousand dollars has been subscribed by manufacturers and business men, and the contract let to the Buffalo Oil Company, of Lima, O. The specifications require the contractors to drill the well 4,000 feet, at a contract price of between \$11,000 and \$12,000. The work will be commenced in thirty days and must be completed within four months.

HARRISBURG, PA.—The contract for heating the public buildings with steam has been given to the Harrisburg Steam Heat and Power Company at \$4,800 for the year ending June 1, 1888. For altering heating apparatus in various buildings the same company takes the contract at \$3,960. For constructing heating apparatus in the Executive Mansion the company has the contract at \$1,960.

LUDINGTON, MICH.—The Brush Electric-Light Company have contracted to put in at Ludington 25 arc-lights at \$80 each per annum.

JACKSON, MICH.—City Council has awarded the contract for street-lighting to the Thomson-Houston Electric-Light Company at \$16,000 for 180 lights burning every night.

CHARLESTON, MD.—A stock company has been formed to sink gas-wells.

MILWAUKEE, WIS.—Incorporated is the Wisconsin Electric Mfg. Co. with a capital stock of \$150,000. Alfred Miller, W. G. Roberts, and A. A. Hoskin are the incorporators, and the company is for owning and operating telephone exchanges in Milwaukee and other cities in Wisconsin.

PHILADELPHIA.—Chief Engineer Park, of the Bureau of Gas, is preparing plans for new gas-works.

BATAVIA, N. Y.—The contract for sinking the Batavia Natural-Gas Company's well has been given to Fitch Adams, of Bradford, Pa.

COOPERSTOWN, N. Y.—Incorporated is the Cooperstown Light and Power Company, with a capital stock of \$20,000. Business is carried on in Otsego. Trustees, Dudley Farlin, J. W. Hutt, C. D. Hammond, H. L. Browning, George W. Kirchway.

FORT SMITH, ARK.—The Fort Smith Natural-Gas and Power Company has been organized, and has elected the following officers: Harry E. Kelley, President; J. Henry Carnall, Vice-President; Talbot Skillman, Secretary; George T. Sparks, Treasurer. The directors elected are: J. L. Tilley, L. W. Rains, William Breen, Sam Felner, and Henry Reutzel.

JEFFERSONVILLE, IND.—Incorporated is the Ohio Falls Natural-Gas Company. Luther F. Warner, A. J. Burlingame, Simon Goldbach, and others.

CHARLESTOWN, IND.—A company has been organized here to bore for natural-gas. Dr. S. C. Taggart, M. B. Cole, F. M. Runyan, and others are directors.

CHATTANOOGA, TENN.—Organized is the Hauss Electric-Light and Power Company. D. J. Hauss, President; H. M. Wilke, Secretary.

BARABOO, WIS.—The city has granted a franchise to light the streets to a gas company.

LYNN, MASS.—The Woodward Underground Telephone and Telegraph Company has applied to the Aldermen for permission to build conduits and lay wires for the police and fire departments. A. T. Woodward is general manager.

NEW YORK CITY.—The Gas Commission opened bids August 23 for lighting the city with electricity. The American Electric Manufacturing Company put in a bid for 307 lamps at the rate of 32 cents each per night in the upper part of the city. The Harlem Lighting Company 300 lamps at 24, 40, 50 and 60 cents each, according to situation, in the upper part of the city. The United States Illuminating Company bid for an indefinite number of lights at 24, 40 and 50 cents each, according to place. The Mount Morris Electric-Light Company bid for 50 lamps only in the lower part of the city west of Broadway at 40 cents each. The North New York Lighting Company bid for 320 lamps in the annexed district at 40 cents each. The Brush Electric Illuminating Company, which received 70 cents for each light last year, bid for 140 at 25 cents and 437 at 40 cents. This company is at present getting 25 cents for each light furnished the city. The East River Electric-Light Company bid for 250 lamps at 19 1/2 cents, 401 at 19 cents, and 153 at 40 cents. The Gas Commission will award the contracts September 1.

PITTSBURG, PA.—The Shenango Natural-Gas Company is laying a new pipe-line and sinking wells. Joseph W. Craig is President; H. E. Pickett, Manager.

FORT WAYNE, IND.—Address J. B. White, President of the Business Men's Association, in regard to the pumping of natural gas from the gas fields 40 miles distant.

GAS COMPANY.—The Secretary of State filed the certificate of incorporation August 18, of the Mahoning Gas and Fuel Company of Youngstown, O., increase of capital stock from \$300,000 to \$500,000.

CHICOPEE, MASS.—The Chicopee Electric Light Company has assumed the contract made with the Thomson-Houston Company for lighting the streets, and will go on with the work.

LITCHFIELD, CONN.—The County Commissioners will advertise for proposals to erect jails at Winsted and New Milford. The plans and specifications for jails and purchase of sites are estimated to call for \$71,989.49.

CANASTOTA, N. Y.—At the election August 18 a resolution was carried by a vote of 125 to 49 in favor of electric lights for the streets. The board of trustees will advertise for bids.

CHARLESTON, S. C.—The Charleston Light and Power Co. will increase their plant at once.

STREET WORK AND PAVING.

BRAINTREE, MASS.—The Selectmen ask bids, until August 29, for building a road from Pearl to Liberty Streets in South Braintree. Address A. O. Clark, Chairman of the Board of Selectmen.

NORTH KINGSTON, R. I.—A report has been prepared on the maintenance of highways.

FULLERTON, CAL.—A large amount of street improvement will be done here. Work on Commonwealth Avenue will be pushed.

STANTON, MICH.—The City Council has ordered a special election for the purpose of voting on the question of bonding the city for improving the highways. The special election will occur on Monday, September 5.

LOS ANGELES, CAL.—An extensive park improvement will be made on the Dominguez property, under direction of William H. Hall, State Engineer. The owners are Judge Charles Silent, D. McFarland, and N. R. Vail.

SAN FRANCISCO, CAL.—A large amount of street paving and sidewalk works is proposed.

TRENTON, N. J.—Bids for paving Clinton Avenue were opened by the City Council August 19 as follows: For resurfacing the present Telford pavement by B. M. & J. F. Shandley: for excavation of earth per cubic yard, 60 cents; for resurfacing with trap rock stone, which will be rolled with a 20-ton steam-roller, per yard, 50 cents.

Martin Van Harlingen, of Philadelphia, presented several bids as follows: for excavation earth per cubic yard, 40 cents; and for Cape Ann granite per square yard, \$2.50; for Philadelphia asphalt block per square yard, \$2.40, with same price for excavation as before; for Goat Hill stone, per square yard, \$2.47, with same price for excavation as in first bid.

D. Lodor, for repairing the avenue with Telford paving, bid 85 cents per square yard, with 35 cents per cubic yard for excavation. For repairing with top dressing, without disturbing the present bed, he bid 65 cents per square yard. Mr. Lodor bid \$2.25 per yard for reaving the street with compressed asphaltum block from Norristown, the excavation to cost the same as before. He also put in bids on granite block and Goat Hill stone, the excavations in each case to be at the rate of 35 cents per cubic yard; granite block \$2.65 per yard, and Goat Hill stone \$2.05 per yard.

The Vulcanite Paving Company, of Philadelphia, bid, saying: "First, we will grade off the surface of the street adjoining the gutter stone for a distance of two feet out, and to a depth of three inches below the top of the gutter-stone, and thoroughly scrape and clean the street. We will then level up all inequalities by placing thereon a hydraulic concrete, composed of Portland cement and sharp gravel. On this, when properly set, we will lay 7 1/2 inches compressed Trinidad asphaltum, for the sum of \$2.15 per square yard. Secondly, we will grade the street to a depth of four inches from the top of the gutter-stone, and for a width of two feet out, and then lay a binder of 2 1/2 inches thick, and finish up with a top coat or wearing surface 1 1/2 inches thick of Hilbert's vulcanite asphaltum, laid as per specifications attached, for \$2.25 per square yard complete. Third, we will grade as in our No. 2 bid and lay a binder of 1 1/2 inches in thickness and on that lay 2 1/2 inches of vulcanite, composed of 3/4 Trinidad asphaltum and 1/4 composition distillate of coal tar, properly mixed with sand and brought to perfect grade, for the sum of \$2.10 per square yard, complete. K Street in Washington City was laid with this pavement in 1875, and is in perfect condition to-day, without one dollar in repairs ever being put on it. Either of the above pavements we will roll with a steam-roller. We guarantee to keep the street in repair for three years."

ROCHESTER, N. Y.—The Rochester and Charlotte Turnpike Company, the Rochester City and Brighton Railway Company, and the Electric Railway Company have all made propositions to the city to build and operate a line of railway down the Boulevard to the Lake. Address Patrick Cox, of the first-named company.

DES MOINES, IOWA.—City Council has passed the ordinance providing for the construction of a viaduct on Summit Street. The cost will be about \$100,000.

ELIZABETH, N. J.—Bids for paving various streets with trap-block, will be opened September 8, by M. M. Watson, Street Commissioner.

SAN DIEGO, CAL.—The principal streets will be paved with bituminous rock.

BROOKLYN.—Chief Engineer Van Buren has prepared plans for raising the grades of streets in the Ninth Ward and the plans are now before Common Council.

ROCHESTER, N. Y.—Council has approved of the following work: Kelly Street macadam improvement; Monroe Avenue asphalt improvement.

BRIDGES.

CHATTANOOGA, TENN.—The stock is nearly subscribed for the building of a bridge over the Tennessee River. The structure will be an iron truss, about 2,000 feet long, including approaches. It is announced that the contract will be given to a Southern company.

Messrs. Merriam & Jarnigan can give further information.

ELIZABETH, PA.—It is proposed to bridge the Monongahela River at this place. The cost will be about \$100,000.

CAIRO, ILL.—The first of the caissons for the bridge over the Ohio River was launched August 20. The Union Bridge Company are the contractors. A. Noble is resident engineer.

SUMMIT, N. J.—It is proposed to build a new iron bridge over Linden Avenue.

FORT JERVIS, N. Y.—The contract for a bridge over Neversink River has been given by the Town Board to the Groton Bridge Company.

LEAVENWORTH, KAN.—The bids recently opened for a bridge on Fifth Street were found to be too high. Proposals will be re-advertised for.

JACKSONVILLE, FLA.—A bridge will be built over Hogan's Creek at Laura Street. Address W. A. Bisbee for further information.

ALFORD, MASS.—The special town meeting has voted to instruct the Selectmen to build an iron bridge across the Green River, known as Williams Bridge. The Selectmen have contracted for the same with the Berlin, Conn., Bridge Company, the town to build the abutment.

NEW YORK CITY.—Proposals for improving the unfinished part of Riverside Avenue, between Eighty-fifth and Eighty-eighth Streets, will be received by the Department of Parks until September 7.

ROCKVILLE, CONN.—Town meeting has decided that an iron bridge shall be built across the river at Talcottville.

NEW ULM, MINN.—On August 20 a mass meeting resolved that Council should be requested to have an iron bridge built over Minnesota River. The Aldermen favor it.

CHATTANOOGA, TENN.—The Anderson Bridge Company is just organized to build a bridge over the Tennessee Market Street. Rough estimates place the cost at \$300,000. Address C. C. Anderson.

NIAGARA FALLS.—The new suspension bridge over the Niagara River, N. Y., will be altered to give a double roadway for teams.

ROCHESTER, N. Y.—The City Engineer is making an estimate of the cost of a new bridge over the river between Alexander and Edinburg Streets.

RUSHFORD, WIS.—Address Supervisor Loope in regard to a proposed iron bridge to be built this season.

OWASSO, MICH.—A new iron bridge will be built over the Shiawassee River at Shiawassee Street.

ST. LOUIS, MO.—The St. Louis Merchants' Bridge and Terminal Railroad Co. filed articles of incorporation in the Secretary of State's office August 18. The bridge is to be erected in the corporate limits of St. Louis; capital, \$1,000,000. The directors are: Seth W. Cobb, C. C. Rainwater, John D. Perry, John M. Gilkerson, John Whittaker, John R. Holmes, and John H. Overall, all leading business men of this city.

MILLEDGEVILLE, GEO.—A bridge will be built over the river here.

RAILROAD BRIDGES.—The Berlin, Conn., Iron Bridge Company has the contract for about 40 bridges on the Mendon and Waterbury Railroad.

BRIDGES.—Bids are now being received for the construction of bridges over the north and south branches of the Shenandoah River. For further particulars address M. L. Garrison, Front Royal, Va.

VISALIA, CAL.—\$12,000 will be applied to town improvement, beginning work at once.

MIDDLETOWN, R. I.—Bids for improving Second and First Beach Avenues will be received by Albert L. Chase, Town Clerk, until September 1.

MUSCATINE, IOWA.—Messrs. Edwards & Walsh have been awarded the contract for building a stone-arch bridge over Papoose Creek; cost, \$5,975.

HARTFORD, CONN.—The contract for building an iron bridge over the Connecticut for the New England Railroad Co. has been awarded to the Boston Bridge Works; cost, \$75,000.

NEW BRITAIN, CONN.—A new bridge is to be built at the Black Rock Crossing of the New England Railroad.

HINDOSTAN, IND.—The commissioners of Martin County propose building a bridge over White River at this place to cost about \$40,000.

BIDS OPENED.

MARSHALL, ILL.—The contract for building the courthouse was awarded August 22 to J. M. Bell, of Paris, and for steam-heating to Watson & Sons, of Terre Haute.

NEW YORK CITY.—Bids for work on the Eighth Regiment Armory were opened by the Armory Board, August 25, as follows:

Mason work: Dawson & Archer, \$175,000; John Cox, \$176,934; James H. Brady, \$177,555; Isaac H. Hopper, \$178,750; Moran & Armstrong, \$144,443; and Edward D. Connolly & Sons, \$160,370.

Carpenter work: McGuire & Sloan, \$92,691; Thomas Overington, \$54,900; Daniel Smyth, \$74,500; James M. Brady, \$67,800; and Mahony Brothers, \$75,780.

Plumbing work: Charles Nally, \$9,250; Scott & Newman, \$10,800; P. J. Andrews, \$10,933; George Cody, \$7,840; John Spence, \$9,500; and John Renahan, \$9,000. The only bid made for the iron work was by the Wallis Iron Works for \$107,047.

For steam-heating and ventilating apparatus the lowest bidder was Baker, Smith & Co., for \$11,745.

It was decided to re-advertise for iron work. The Board expects to supervise the bids so as to confine the total cost of the armory to \$300,000. The estimated cost of the armory is \$325,975.

MILWAUKEE, WIS.—New school building in the Ninth Ward. For the building: Charles Kraatz, \$22,448; A. H. Vogel, \$22,648; F. Niezorski, \$22,850; H. Schlenstedt, \$22,970; G. F. Stuewe, \$23,500; Henry Tesch, \$23,637; William Klocksin, \$24,500; J. H. Lemcheek, \$25,250; Wenzel Strachote, \$25,385.

For the steam-heating apparatus: H. Mooers & Co., \$3,740; M. Coogan, \$3,340; Charles A. Barker, \$2,929.

For the plumbing: William E. Goodman, \$910; P. H. Murphy, \$890.

The contracts were let to the lowest bidders. The Union School Furniture Co. will furnish the desks and seats: "C" and "D" desks, \$3.15 each; "E" desks, \$3.05 each; fronts and backs of all sizes, \$2.75 each.

WATERVILLE, N. Y.—The following bids for water-works construction were received by I. D. Brainerd, President of Water-Works Trusts, August 20:

Sullivan & Stafford, Little Falls, N. Y., for the works complete, \$50,600.57.

Sherman & McDonough, Utica and West Troy, for the works complete, \$51,450.

Riden & Dougherty, Vonkers, N. Y., for the works complete, \$55,566.81.

Chambers & Casey, Rochester, N. Y., for works, except pipe and specials, \$28,777.30.

G. W. White, Pulaski, N. Y., for the works complete, \$51,047.90.

Sullivan & Stafford, for work only, \$24,673.12.

Chambers & Casey, for work only, \$26,442.10.

G. W. White, for work only, \$22,754.30.

Warren Foundry and Machine Co., Reading, Pa., pipe, \$22,304.50; specials, \$428.25.

C. Millar & Son, Utica, N. Y., pipe, \$22,745.96; specials, \$415.76; hydrants, \$1,484.75; valves, \$648.55; valve-boxes, \$100.

R. D. Wood & Co., Philadelphia, pipe, \$24,049.35; specials, \$438.11; hydrants, \$1,484.75; valve-boxes, \$98.25.

Mellert Foundry and Machine Co., Reading, pipe, \$25,393.80; specials, \$381.37; hydrants, \$1,336; valves, \$668.

Builders' Iron-Works, specials, \$400.25; valve-boxes, \$99.

Eddy Valve Company, hydrants, \$1,210; valves, \$611.40; valve-boxes, \$99.

Tamaqua Manufacturing Co., Tamaqua, Pa., hydrants, \$1,207.

Chapman Valve Mfg. Co., hydrants, \$1,136; valves, \$656.41.

Ludlow Mfg. Co., hydrants, \$1,411; valves, \$668.10; valve-boxes, \$110.28.

Coffin Valve Mfg. Co., valves, \$556.

Contract awarded to G. W. White, Pulaski, N. Y., for work only, village to furnish pipes, hydrants, and valves. Contract price for work \$22,754.30.

ST. LOUIS.—The following bids for 30 tons of 3 and 4-inch water-pipe and 50 tons of special castings were received by the Board of Public Improvements, August 15: Shickle, Harrison & Howard Iron Co., St. Louis, water-pipe, \$39 per ton, total, \$1,170; special castings, \$55 per ton, \$2,750. The contract was awarded at those figures.

BRAINTREE, MASS.—The following bids for laying about twelve miles of cast-iron water-pipe in the town of Braintree, were received by the Water Commissioners, August 15:

John Cavanagh, Braintree, 16-inch pipe, 50c. per foot; 12-inch, 40c.; 10-inch, 35c.; 8-inch, 30c.; 6-inch, 25c.; 4-inch, 20c.; total, \$10,508.15.

John O'Connor, South Boston, 16-inch, \$1; 12-inch, 80c.; 10-inch, 70c.; 8-inch, 60c.; 6-inch, 50c.; 4-inch, 40c.; total, \$9,036.30.

A. H. Howland, Boston, for all, \$16,346.18.

W. C. McClellan, Boston, for all, \$22,000.

The contract is not yet awarded.

LYNN, MASS.—The following bids for constructing Section 3 of Haskell Intersecting Sewer were received by John C. Haskell, City Engineer, August 22:

BIDDER AND RESIDENCE.		
Edward F. Brigham, Cambridge,	95 00	Cu. yds. earth exc., 10,824, A.
Edward C. McCallan, Boston, Mass., ..	1 21 30	Cu. yds. rock exc., 200, B.
James Heath, Lynn, Mass.,	70 5 00	Cu. yds. earth exc., refilling above grade, 200, C.
	57 0 00	Cu. yds. concrete, 67, D.
	11 25 00	Cu. yds. brick masonry and cement mortar, 1,650, E.
	11 25 00	Cu. yds. rubble stone masonry, 30, F.
	50 0 00	Linear feet 10 in. drain-pipe in place, 3,480, G.
	23 0 00	M. ft. B. M. per lumber in place and secured, 10, N.
	65 0 00	Catch-basins, 21, I.
	65 0 00	12" conn. pipe from basins to sewer, 350, J.
	50 0 00	Superficial feet footing stone, 190, L.
	50 0 00	Purch stone masonry in sidewalks, 35, M.
	75 0 00	Superficial feet covering stone, 565, N.
	75 0 00	Linear ft. of 18" drain-pipe in place, 45, O.
	80 0 00	Linear ft. of 12" drain-pipe in place, 318, P.
	33 317 95	Total.

LYNN, MASS.—The contract for building sewer from Bay Meadow to the eastern terminus of the intercepting sewer (Sec. 3) has been awarded to James Heath.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 14. } PUBLISHED EVERY SATURDAY.

NEW YORK, SEPTEMBER 3, 1887.

LONDON, SEPTEMBER 17, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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THE RIGHTS OF THE PEOPLE TO WATER FOR THE USE OF TOWNS AND CITIES.

THIS question is one that is destined to become increasingly prominent as the population increases, the country becomes more developed, and the available supply of water in times of scarcity becomes less and less. This subject is presented under the head of a "Resource for Cheap Water for the People" in the last publication of the New England Water-Works Association. It seems that in at least two States (Massachusetts and Maine) all natural bodies of water of over ten acres in area are legally styled "Great Ponds," and have always been public property—no private title approaching nearer than low-water mark. The State of Massachusetts has adopted the principle of giving this water free to municipalities requiring it. The argument by T. M. Stetson, Esq., submitted at the time of the application of Fall River for condemnation of the water of Watuppa Ponds, is given in full in this paper. It is based on two propositions:

"First—The State owns the water in these 'Great Ponds' and may well give from it to its people without toll or payment.

"Second—That any ancient licenses or privileges heretofore allowed to parties to use, control, and avail of the surplus waters after they pass into the outlet stream (the Quequechan or Fall River) shall, so far as they legally may, be revoked or prevented from standing now in the way of the proposed gift from the State to its people."

The opponents of the application held that they had a prior right from continued use under a license given in 1826, but the argument states that the Supreme Court of the United States had in three cases decided against the irrevocability of such licenses.

The State had in 1647 consecrated the Great Ponds to the public forever, and Justice Hoar upheld this in a written opinion, stating, "There is no adjudged case in which any right in them adverse to the public has ever been recognized." This same opinion quotes from several other opinions as follows:

"Riparian owners on the stream own the uses of the water that actually succeeds in getting into the stream, but that is all.

"The use which every owner in a running stream may claim is only of the water which has entered into and become a part of the stream.

"The grant by the Legislature of an exclusive right to the water-power of a navigable stream does not give title to the corpus of the water. Hence a subsequent grant to the district to erect water-works to supply its inhabitants with water is not in violation of the previous grant of the water-power.

"An upper owner has an unqualified right to drain his marsh, and a neighboring proprietor cannot complain of deprivation of water which would otherwise come to his land, etc.

"Water taken from a pond before it could reach the outlet never could be water flowing from the pond.

"In short, until water gets into a defined water-course, it has no relations with the riparian owners along such water-course. The line of demarkation of the title is at the point where the water *de facto* leaves the Great Pond and enters the water-course. Till then it belongs to the State, afterwards to the riparian owners on the stream."

Numerous other decisions are quoted to show that no license by the State can be held to be

irrevocable, or to withhold the State from exercising its sovereignty should occasion arise.

So in this case "the ancient policy was to encourage mills, but never at the expense of the people's thirst and cleanliness.

The bill that was passed last year in the case of the city of New Bedford is appended. It provided for the taking and using of the waters of Little Quitticas Pond, without liability for other damages than the State itself would be liable to pay.

The city of Worcester is now defending a suit for diversion of water, but the testimony thus far published is too meagre to give an intelligible statement of the case. It is well that all who are interested in water-works become fully acquainted with the principles underlying such cases, so clearly and admirably stated in the one before us.

COMPARATIVE SANITARY CONDITION OF THE PRINCIPAL CITIES OF EUROPE IN 1886.

IN *Revue d'Hygiene* for June, 1887, Dr. Jacques Bertillon, the Chief of the Bureau of Statistics of the city of Paris, publishes a memoir under the above heading, being a continuation of a similar report made by him last year, which was duly noticed in THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

In this paper he gives the proportion of deaths per 100,000 of living population for each of certain preventable diseases. The proportion of deaths per 100,000 of population reported as caused by typhoid fever during the year 1886, was, for Paris, 46; Marseilles, 108; Bordeaux, 60; Lyons, 40; Nancy, 65; Toulouse, 118; Besancon, 205. These are high figures as compared with those for the cities of other countries,—as, for example, London, 17; Edinburgh, 15; Liverpool, 34; Manchester, 33; Berlin, 16; Dresden, 18; Leipzig, 11; Vienna, 11; Brussels, 29; Amsterdam, 16; Copenhagen, 13.

A few large cities have, however, suffered greatly from this disease—e.g., Saragossa 128; St. Petersburg, 113; Milan, 71; Philadelphia, 65; Baltimore, 46.

The great outbreaks of small-pox during the year are shown by the following figures, giving numbers of deaths per 100,000—viz.: Marseilles, 573; Rheims, 110; Budapest, 358; Saragossa, 221; Rome, 128; Milan, 64; Zurich, 106. In like manner some of the figures for scarlet fever were: Paris, 18; Lyons, 13; Marseilles, 5; London, 17; Liverpool, 47; Leeds, 57; Glasgow, 68; Berlin, 21; Hanover, 285; Leipzig, 28; Munich, 34; Budapest, 127; Vienna, 16; Amsterdam, 6; Rome, 5; St. Petersburg, 93; Brooklyn, 51.

For diphtheria in like manner some of the figures were: Paris, 73; Marseilles, 163; Lyons, 38; London, 33; Liverpool, 21; Glasgow, 29; Edinburgh, 32; Berlin, 128; Dresden, 169; Hamburg, 123; Leipzig, 110; Munich, 86; Nuremberg, 240; Budapest, 128; Amsterdam, 74; Grenada, 491; Rome, 52; St. Petersburg, 63; Brooklyn, 170; Philadelphia, 113.

All the above diseases are liable to occur in epidemic form, and an outbreak in a particular city may make it appear very unhealthy for that year, although ordinarily its sanitary condition is good. It is different with another disease of which Dr. Bertillon gives the statistics, and for which the figures do not show such great differences. This is consumption, from which in each

100,000 inhabitants there died in Paris, 470; Marseilles, 448; Lyons, 444; London, 202; Glasgow, 278; Edinburgh, 193; Belfast, 472; Berlin, 334; Dresden, 387; Leipzig, 315; Munich, 390; Nuremberg, 482; Budapest, 708; Vienna, 664; Brussels, 315; Rome, 212; Brooklyn, 313; New Orleans, 382; Philadelphia, 296.

It will be found interesting to compare these figures with those for the preceding year, and on doing so it will be found that the changes have not been great, but are mostly for the better; that the French cities suffer most from typhoid, the English from scarlet fever, the German from diphtheria, and the Austrian from consumption.

NEW YORK AQUEDUCT COMMISSIONERS' REPORT.

THE New York Aqueduct Commissioners are to be commended for the wise expenditure that has given to the public and the profession so valuable a publication as their reports for the

undertaking, and engineers are often to blame if the expenditure be not authorized, though we believe in the case of the Brooklyn Bridge the failure to make it was due to a false notion of economy on the part of the trustees. In the case of the aqueduct report the receipts from sale of copies are expected to nearly cover the cost of publication.

AMERICAN PUPILS' PRIZE AT ECOLE DES BEAUX-ARTS.

ELSEWHERE in this issue will be found a quotation from *La Semaine des Constructeurs* giving an account of the foundation of an annual prize for French students of the Department of Architecture at the Ecole des Beaux-Arts. The fund was made up of contributions from certain American architects, former pupils of the Paris school, and a few friends interested in the profession of architecture. The seven thousand dollars thus donated is a generous response from

templated in this prize foundation. Indeed, it would be much easier to secure an endowment for an art school to be located in the bottom lands of Arkansas.

IN connection with our note on "How to Dress in Hot Weather," given in THE SANITARY ENGINEER AND CONSTRUCTION RECORD for August 20, attention is called to the communication from General M. C. Meigs, printed in another column, which gives some positive data as to the temperatures to which those who dress in black clothes in the summer may be exposed.

OUR SPECIAL ILLUSTRATION.

RESIDENCE OF WILLIAM EDGAR, NEWPORT, R. I.—M'KIM, MEAD & WHITE, ARCHITECTS.

OUR special illustration is of the residence of William Edgar, Esq., Newport, R. I. McKim, Mead & White are the architects.



RESIDENCE OF GEORGE P. SAWYER, BUFFALO, N. Y.—GREEN & WICKS, ARCHITECTS.

period 1883-1887, a synopsis of which we give elsewhere in this issue; an acknowledgment is likewise due Mr. B. S. Church, the Chief Engineer, and the Secretary, Mr. J. C. Sheehan, for the great labor involved in the preparation of the mass of statistics given. The illustrations help to lighten up the report and to give a clearer idea of the arrangement, while the constructive details are of great value and will be fully appreciated by engineers.

It is a pity that those responsible for the affairs of the East River Bridge should have been willing to let the great mass of valuable experience obtained in its construction be in a measure lost. The annual reports issued cannot take the place of a fully illustrated report, and each day it will become more and more difficult to reproduce the details as left by the builders. Drawings become scattered, lost, or illegible, and note-books, on which so much depends, very soon disappear. The public is always willing to bear this portion of the expense of an engineering

the limited number who knew anything of the movement and contributed the money.

We have a letter suggesting that the originators of the movement to raise this fund should have "endeavored to secure from the National Congress an appropriation of a sum of money as a substantial endowment, to be deposited with the *Ecole des Beaux-Arts*, not merely in the name of American architects, but also to include the thousands of sculptors and painters who have profited so largely by what they have studied under the French master."

Even it were proper to appeal to the Government for funds for such a purpose, we think the committee acted wisely in not attempting so quixotic a scheme. What they have so quietly done is a graceful act of appreciation, and is so considered by the French friends of the school. Moreover, the views entertained by Congress on questions of this sort would lead us to conclude that no architect now living would live to see an appropriation made for any such purpose as is con-

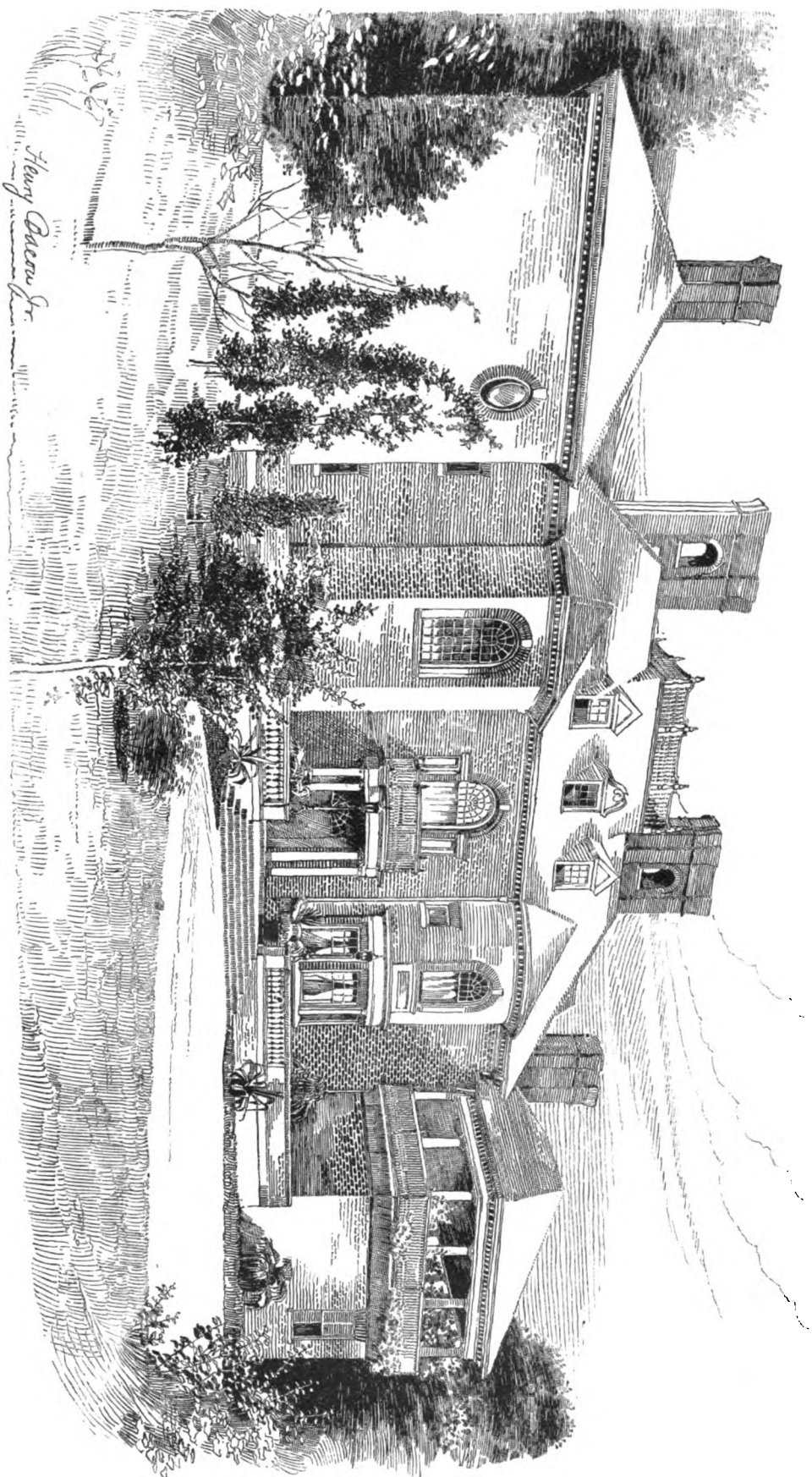
OUR VIGNETTE ILLUSTRATION.

RESIDENCE OF GEORGE P. SAWYER, BUFFALO, N. Y.
GREEN & WICKS, ARCHITECTS.

THE subject of our vignette illustration is the house of Mr. George P. Sawyer, on Ferry Street, Buffalo, N. Y. It is of wood, all the stories shingled. White oak in dining-room and hall, elsewhere pine, painted; colonial finish. The plastering in halls and dining-room is in wire gauzed pebble, dark. The cost was \$10,000. The architects were Messrs. Green & Wicks, of Buffalo, N. Y.

BRICK PAVEMENTS IN CHARLESTON.

MR. T. A. HUGENIN, Superintendent of Streets, Charleston, S. C., writes us in response to our reference to a brick pavement in Cincinnati, on page 318, issue of August 20, that bricks prepared in accordance with a method patented by him have been "laid in Charleston for three years, and subjected to the heaviest traffic" of that city "with entire satisfaction, showing less wear than the granite block immediately adjacent."



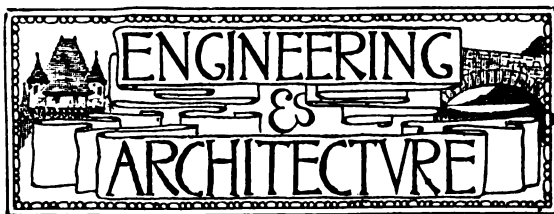
THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

RESIDENCE OF WILLIAM EDGAR, NEWPORT, R. I.

MCKIM, MEAD & WHITE, ARCHITECTS.

NEW YORK, VOLUME XVI.

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THE AMERICAN PUPILS' PRIZE AT ECOLE DES BEAUX-ARTS.

[Translated from *La Semaine des Constructeurs*.]

A NUMBER of American architects, former pupils of the Ecole Nationale des Beaux-Arts, and other generous citizens of the United States, have recently made a gift to the school of a sum of 35,000 francs, to establish a prize in favor of the French pupils of the department of architecture.

Their delegate, M. Richard Hunt, architect, correspondent of the Académie des Beaux-Arts, in the following terms informs M. Paul Dubois of this liberality, which attests the deep gratitude of the donor toward our country:

THIRD ANNUAL EXHIBITION OF THE ARCHITECTURAL LEAGUE.

THE third annual exhibition of the Architectural League will be open to the public at the Fifth Avenue Art Galleries, 366 and 368 Fifth Avenue, New York City, on Monday, December 19, 1887, and will continue for three weeks.

The exhibition will consist of work not before exhibited in New York City, and representing, as far as practicable, the work of the past year.

The exhibition is to be devoted to architecture and the allied arts, as may be represented, as follows:

Architectural designs, perspective drawings, sketches in pencil, pen and ink, water colors, charcoal, etc., elevations and photographs of executed work.

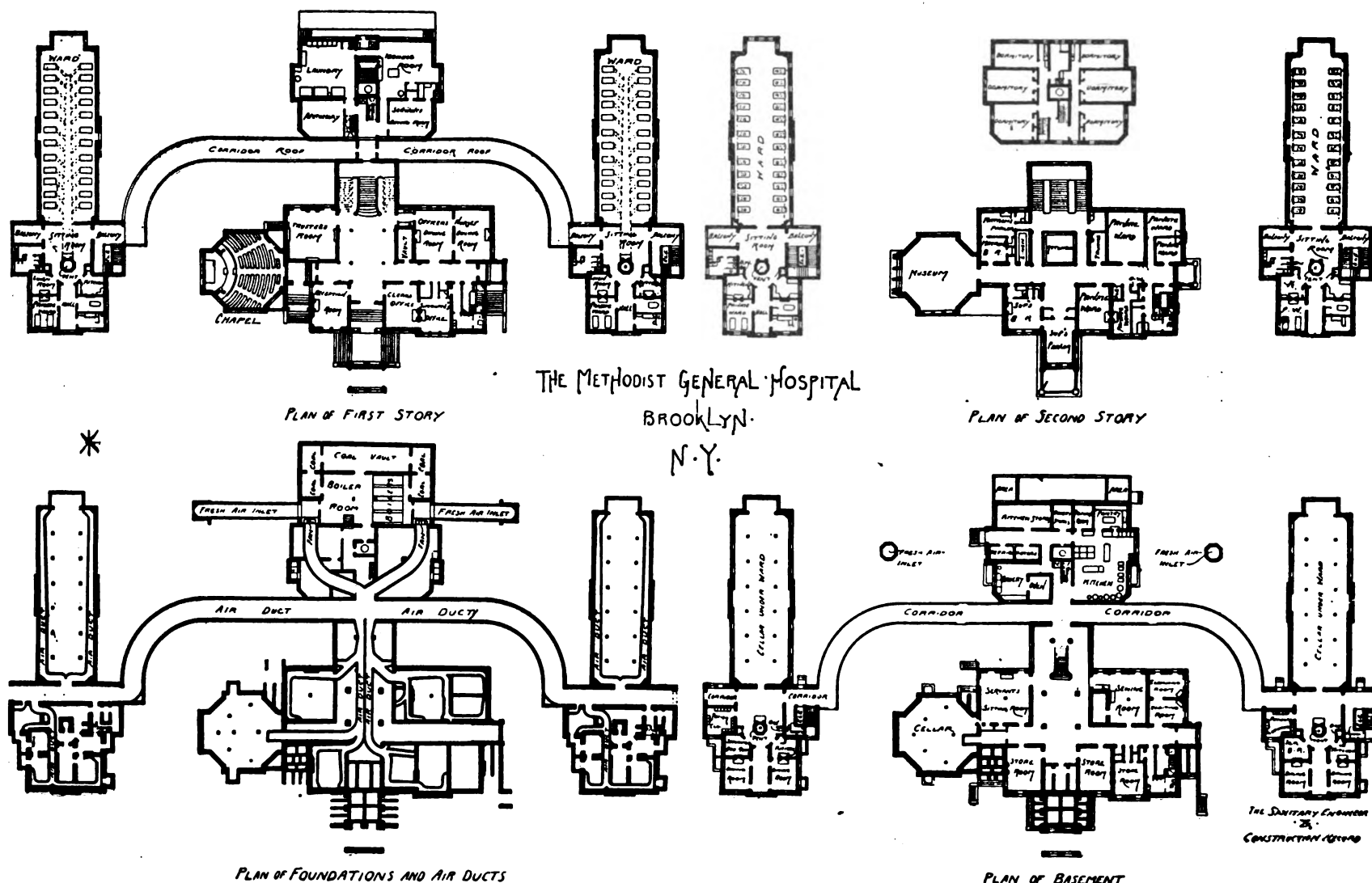
Sketches for interior decoration and furniture, designs, and cartoons for stained glass, mural decoration and paintings of foreign work.

Stained glass, wood carving, mosaic, and casts and models of executed architectural and decorative work.

A detailed circular of blanks as to jury, framing, transportation, etc., is now being prepared and can be had after October 1 on application to the Secretary, Charles I. Berg, at 152 Fifth Avenue, New York.

The building is of brick, trimmed with New Jersey freestone. It is fire-proof, the floor-beams, partitions, and stairs being of iron, and the roofs of iron, asbestos, and slate. There is no wood-work on the exterior, all cornices and dormer windows being of stone. The windows and porches are ornamented with handsomely carved capitals in different designs.

The basement story is ten feet high, and is designed to contain a sitting and reception room for employees, a sewing-room, toilet and storerooms, an accident-reception ward and an examining-room. In this basement is to be placed the heating-apparatus for the building, to consist of boxes enclosing steam-coils, which receive supplies of fresh air from air-ducts leading to them from a common inlet, the supply being insured and regulated by a fan. These boxes each communicate with flues that pass upwards in the walls of the building to the various rooms on each floor, where they open by suitable registers. These flues are made of galvanized iron, and in each case their capacity has been made the subject of careful calculation, to insure the full delivery of an adequate amount of fresh air in the room supplied by it. An inspection of Fig. 2 will show the course of the primary air-ducts, as they form a part of the foundation plans of the buildings. There will be seen also an extension of these air-ducts to the pavilions. In the pavilions, however, they are merely accessories to a different system of air-supply, arranged for those buildings, which will be described in an appropriate connection. It should be noted here that from all the rooms of the main central building adequate exhaust-flues to carry off vitiated



"SIR: The architects of the United States, feeling a sincere gratitude toward the Ecole des Beaux-Arts, desire to give to their sentiments an expression which will forever recall the generous bounty of the school, so lavish in its care for the artist students of all nationalities.

"They desire to found for the French architectural pupils of the school an annual prize which shall be entitled 'Prix de reconnaissance des architectes Américains.'

They desire to found this prize in favor of the French pupils alone, in order the better to accentuate their gratitude toward France. To this end, the former pupils of the school and others have subscribed the sum of thirty-five thousand (35,000) francs.

They desire that the interest on this sum shall constitute an annual prize.

Hoping that this communication will be received with favor, and reiterating their expressions of gratitude, they pray you, Monsieur le Directeur, to accept the assurance of their devotion and of their highest consideration.

(Signed)

RICHARD M. HUNT,
President.

The secretary has also issued a circular, accompanied by a blank form, requesting architects to furnish him with their full names and addresses, the purpose apparently being to secure a correct list of the profession.

GENERAL DESCRIPTION OF THE METHODIST GENERAL HOSPITAL.

THE plot of land constituting the hospital grounds consists of the entire city block bounded by Seventh and Eighth Avenues and Sixth and Seventh Streets, in the city of Brooklyn. The grounds are rectangular, being 695 feet 9 inches from east to west, and 200 feet from north to south. The architect was Mr. John Mumford, of Brooklyn.

THE BUILDINGS.

The buildings front upon Sixth Street, and consist of a main central building, an accessory central building, and two pavilions, one on either side of the main building. The basements only of these buildings are connected by light corridors.

The Main Central Building is 155 feet 6 inches in length and 92 feet in depth, exclusive of the tower, which projects 19 feet. The height to the top of the cornices is 61 feet 8 inches, and to the top of the tower 126 feet.

air lead, which are gathered together beneath the roof above, where they open into appropriate louvred lanterns to discharge their contents into the outer air. There will be an elevator from the basement to the third story.

The first story will be 18 feet high, and will contain the manager's room, general reception-room, officers' and nurses' dining-rooms, superintendent's and clerks' offices, toilet-rooms, and the chapel. The latter is octagonal in plan, with ceiling 22 feet high, and will seat 160 persons. The plan is so arranged that the public can attend services in it without entering the hospital proper.

The principal entrance to the building is through a vestibule 17 feet 6 inches wide. This opens into a grand corridor 30 feet wide, from which springs the main staircase. The central portion of this corridor forms a rotunda, 17 feet in diameter, which is supported by cast-iron columns, and extends upwards to the roof, where it is surmounted by a glass dome light.

The second story, 15 feet in height, is planned to contain living-rooms for the superintendent and matron, and a number of private rooms for paying patients. A room for a library and museum purposes is provided over the chapel. This room is octagonal in plan, 40 feet in diameter, with ceiling 24 feet high, surmounted by a large skylight.

The third story is 13 feet high, and is arranged for one ward of ten beds, with the necessary service rooms. Six

smaller rooms for patients are also provided for on this floor.

The fourth story is intended to be devoted to dormitories for nurses, and will afford ample accommodation for thirty persons.

On each floor, from the basement to the fourth story, isolated by a branch corridor of some length, toilet-rooms are placed in the north-western corner of the building, provided not only with abundant cross-ventilation by windows, but also with a special exhaust ventilating-chimney, into which flues lead from each water-closet bowl. The walls of the toilet-rooms are built of enameled bricks.

In this part of the building, also, is placed a second staircase which, beginning at the basement, communicates with every floor.

This building, besides providing for the various administrative offices and residences, the chapel and museum, and the home for nurses, will afford accommodations of a superior character for about 30 patients.

THE ACCESSORY CENTRAL BUILDING.

This building will be placed directly in the rear of the main central building, and be connected with it by a covered corridor. It will be 54 feet deep and 80 feet wide, and will front on Seventh Street. It will be two stories in height, with a high mansard roof, containing a full story and an attic. It will have a basement, in which will be placed the boilers, engine, coal-vaults, and fan-blowers for supplying the air-currents, brought through ducts leading from large ornamental shafts in the grounds adjacent to the general system of fresh-air ducts of the institution.

The first story will contain a kitchen, preparing-room, bakery, storerooms, and refrigerators.

The second story will contain the laundry ironing-room, employees' dining-room, and apothecary's shop.

The third story will be occupied exclusively for dormitories for employees, with necessary toilet-rooms.

In the attic there will be a disinfecting-room.

THE PAVILIONS.

These contain the main or common wards, and the necessary service rooms. There are two of them, alike in every respect, one on each side of the main central building, and distant from it 40 feet. The extreme width of the front or service portion of each pavilion is 60 feet, and the total depth of the pavilion is 150 feet. The portion containing the wards is of two stories, with a basement. The basement is 9 feet high, entirely above ground, fully lighted by windows uniform in number with those of the floors above, with concrete floors, plastered ceilings, and whitewashed walls. It will contain nothing except the apparatus for heating and ventilation.

The wards proper are rectangular, 96 feet long and 32 feet wide. Their height is 15 feet. There is one window to every two beds; the windows on the two sides are placed directly opposite each other, and in the upper part of each window-frame is a transom-sash. The long axis of the wards runs nearly north and south, and the wards have a full and uninterrupted exposure upon the east, south and west sides respectively. Each ward is calculated to contain twenty-four beds, and in that case would provide nearly 2,000 cubic feet of air-space, 128 square feet of floor-area, and a wall-space of 8 feet, including windows, to each bed. A constant and copious supply of fresh air is provided for by registers placed in the walls between each window, which communicate with flues that lead to external openings in the basement-walls eight feet above the surface of the ground. These flues also communicate with heating chambers, enclosing steam-coils, placed in the basement, and, by suitable valves, the air-current may be made to pass through these heating chambers, or directly upward into the ward above. The temperature may thus be regulated, but in no case can the volume of air be interfered with. These flues likewise communicate with the air-ducts leading from the central fans described in connection with the main central building, by means of which the power of forcing or accelerating the ventilation of the wards will be supplied whenever the natural powers of aspiration, upon which the ward system of air-supply depends, is found deficient.

For the removal of vitiated air from the wards equally complete provision is made by means of two great aspirating chimneys in each pavilion. From apertures, suitably guarded, beneath the foot of each bed in the floors of the wards, and from a series of registers placed near the ceiling of the lower ward, and along the centre of the ceiling of the upper ward, foul-air ducts lead that converge to common ducts that finally empty into great aspirating chimneys, where, by means of steam-coils, a constant force of aspiration is maintained. The arrangement of the floor foul-air flues of the lower ward is well shown in the plan of the pavilions.

In addition to these, four open fire-places are provided in each ward, one in each of its corners. Each of these becomes, when in use, an accessory aspirating flue.

The wards open at their northern end into a wide corridor, which is enlarged so as to form a convenient sitting-room for convalescents. Around this cluster the service rooms for each ward. The arrangement is shown in the engraving. On either side this corridor leads to a wider open balcony upon which the staircases and the elevator shaft that connect the floors open. The isolation of each floor is thus accomplished, there being no communication between the floors of the pavilions without first passing into the open air of the balcony. Each ward is provided with water-closets, lavatory, bath-room, nurse's day-room, linen closet, scullery, and closet for patients' clothing, none

of which communicate directly with the ward. In addition an isolating room, capable of receiving two patients, is provided for each ward.

In the basement of the service portion of the pavilion is provided a dining-room for convalescents, and a dormitory for servants, and an isolating room for maniacal patients. The basement corridor is continuous with the general corridor that connects all the buildings. A separate lift is provided, leading from the basement to the scullery of each ward. To this service portion of each pavilion is added a third story, in which is provided residence apartments for the hospital *internes*, also a small isolated ward for one patient and a laboratory room.

THE RECEIVING RESERVOIR OF THE WASHINGTON AQUEDUCT.

GENERAL M. C. MEIGS writes the following letter to the *Washington Star*:

"A statement is published that a late storm swept into the receiving reservoir of the Washington aqueduct the drainage of 36 square miles of surrounding territory. The same paragraph also states that the streams flowing into the reservoir drain about 10 or 11 square miles. The case is not so bad as reported. The actual drainage area of the valleys above the dam across Little Falls Branch, which creates this reservoir of some 56 acres, is about 4,000 acres, or 6 square miles, unless my memory of my original surveys greatly errs. I ran out the lines of watershed, and remember them quite positively as inclosing 4,000 acres. But man's memory is not always to be relied on after an interval of 34 years. But the storm-water of such a flood soon runs off through escapes provided for it, and the waters sent into the city are mostly from the Potomac, which itself drains some *thousands* of square miles. To cut an intercepting ditch around the margin of this reservoir will have a good moral effect, but it will not keep out of our city the drainage of many square miles of cultivated and uncultivated land. The upper end of the reservoir was originally excavated to a sufficient depth with intention that all deposits settling at the outlet of the stream should be periodically dredged out of the basin. This could be done for from 15 to 20 cents per cubic yard. But its necessity has been overlooked, apparently, by those in charge. There were means for allowing great floods to escape over the by-pass and outlet, and other means for drawing off, through the culvert under the dam, all waters that at any time appeared unfit for the city service. To carry all flood-water around the reservoir will require a large intercepting ditch. Houses below the dam have been swept away by the stream when angry. This happened during the work of constructing the dam."

ASPHALT AND CONCRETE FOOT PAVEMENTS.

IN the discussion following the reading of Mr. Strachan's paper on "Asphalt and Concrete Foot Pavements," published in our issue of August 13, we learn from the *Builder's* report that Mr. Vawser, of Manchester, mentioned the advantage which was experienced at Macclesfield by laying concrete footpaths in about 4-foot squares, and putting between each a piece of plank. It was found that the elasticity of the planking was sufficient to prevent any cracking.

Mr. Fowler, of Manchester, agreed as to the great value of concrete paving, which, seven years ago, he used for the Newcastle Cattle Market. There he placed a lath round the boundary of each section, and there was not a single crack.

Mr. Ellice Clarke, of London, said his experience of an asphalt footpath $\frac{3}{4}$ -inch thick was that at the end of three years it required very considerable repairs. The unsightliness of cracks in asphalt was their principal objection; they did not detract at all from its wearing well. The practice mentioned by Mr. Vawser had been discontinued by all who had had much experience of asphalt. Now it was usual to lay two slabs of concrete on alternate days, or two or three days.

Mr. Boulnois, of Portsmouth, said that some of the earlier samples of ferrumite stone had too much iron in them, and being thus too hard, had a very slippery surface. The secret of the wear of asphalt lay in a nutshell. Unless it got sufficient traffic upon it it would never consolidate properly.

Mr. Lemon, of Southampton, said that twenty years ago he was very enthusiastic about asphalt, and his Corporation laid a great deal of it down. He had come to the conclusion now that there must be a very large traffic over it, or at least sufficient to keep it together. Otherwise it was bound to fail. Some laid down $\frac{3}{4}$ -inch thick soon wore out, but some laid 2 inches thick in a roadway where there was great traffic had been down for fifteen years, and had never cost sixpence for repairs. With respect to concrete, he thought concrete made and laid *in situ* was the footpath of the future.

NEW YORK AQUEDUCT COMMISSION REPORT.*

THE Commission organized under the act of Legislature passed June 1, 1883, and the report gives a history of all transactions up to the close of the operations of last year.

The report of Mr. Spencer gives an account of the organization and changes in the Commission; of the public hearings and discussions; of the appointment of the Chief Engineer August 15, 1883; the adoption of plans and profile of location February 27, 1884, and of subsequent modifications, and of the award of contracts (three to Messrs. O'Brien & Clark, four to Brown, Howard & Co., and two to Heman Clark) for nine sections of the work on December 13, 1884. The expenditures for the year 1884 were \$185,760.63.

May 13, 1885, plans for the new gate-house at Croton Dam were adopted, and, July 30, the contract awarded to James S. Smith and Henry H. Brown. In the fall of 1885, and up to April 1, 1886, hearings were again held on the matter of the proposed Quaker Bridge Dam.

December 2, 1885, the conclusion was reached that the Sodom Dam and reservoirs should be constructed immediately.

The expenditures for 1885 were \$2,265,147.58.

February 17, 1886, resolution passed to line the whole aqueduct with brick.

January 28, 1886, the terminus of the New Aqueduct was fixed at the northerly side of the largest reservoir in Central Park.

October 15, 1886, the tunnel between shafts 0 and 1 met, the lines agreeing within $1\frac{1}{4}$ inches.

The expenditures for 1886 were \$5,029,684.21, the total to date for a period of three years, four months, and twenty-three days being \$7,503,310.32.

The first year of this time was spent in surveys, location, adoption of plans of construction, obtaining title to land, etc.

The leading dimensions are given as follows:

AQUEDUCT TUNNEL.

Length of tunnel and open cuts from Croton Dam to Harlem River to be.....	28 $\frac{1}{2}$ miles.
Length from the north-easterly shore of the Harlem to gate-house at One Hundred and Thirty-fifth Street and Convent Avenue.....	2 $\frac{1}{2}$ "
Total.....	30 $\frac{1}{2}$ "
Length of pipe-line from gate-house, One Hundred and Thirty-fifth Street gate-house, will be 12,525 feet, or.....	2 $\frac{1}{2}$ miles.
Total length of Aqueduct.....	33 $\frac{1}{2}$ "

Of this 22.65 miles was excavated January 1, 1887, leaving 8 $\frac{1}{10}$ miles to be excavated at that date.

SHAFTS.

Of these thirty-five were completed and three to be contracted for.

The greatest depth of shaft from surface was..	350 feet.
The least depth " " " "	28 "
Aggregate depth of shafts excavated.....	4,491 "
Average depth of the tunnel below surface. . .	170 "

The President hopes that the Sodom dams and reservoirs, to be known as the "East Branch Reservoir," will be completed before the close of the year 1888, as well as the Muscote Dam and Reservoir, and that these will be sufficient for present supply.

The Quaker Bridge Dam he leaves in abeyance for still further consideration.

Then follows the report dated March 7, 1883, made by Mayor Edson and the committee appointed by him on the question of supply and the urgency for large additions at the earliest practicable moment.

Then an exhibit giving the rules adopted for the selection and appointment of inspectors on the work.

The report of the Secretary comprises a classified statement of expenditures and a list of officers, and a complete list of the engineering organization.

The report of the Chief Engineer contains a succinct account of the work done under his charge. He alludes justly to the embarrassment likely to arise from the requirements in the Aqueduct law, that the plans, contracts, and specifications be submitted by the Department of Public Works; but that the courtesy of those in charge of this department had warded off unpleasant conflicts.

* Report to the Commission by the President, James C. Spencer, Esq. Containing reports of the Secretary, John C. Sheehan, and Chief Engineer B. S. Church.

He refers to the preliminary work and plans of Chief Engineer Isaac Newton, and their endorsement by him and other engineers of the Quaker Dam project. He mentions the public discussions, and then passes to the consideration of the New Aqueduct, giving a complete description of the final location, the letting of work, organization of force, etc.

He then considers the "Character of the Rock and Earth," "The Quality of Masonry Construction," "Supply from the Croton River," "Bids and Contract Prices," "Shaft Excavation," "Tunnel Excavation and Lining," "Contractor's Plant," and ends with acknowledgment of the services rendered by his assistants.

Then follow reports by Commissioner Hubert O. Thompson of August 8, 1883, submitting plans for the aqueduct, and September 11, 1883, endorsing the Quaker Bridge Dam.

The volume closes with tables of the (1) monthly rainfall in Croton Basin, 1870-86; (2) monthly and yearly flow of Croton River, 1870-86; (3) daily flow of Croton River for each month, 1870-86; Profile 1, rainfall and flow of river for each month, 1870-86; Profile 2, average monthly rainfall and flow, 1870-86; Diagram 1, storage required for daily supply of 250 to 400 million gallons; Table 4, analysis of bids on each section; Table 5, quantities and prices of contracts for each section; Table 6, list of contracts awarded; Table 7, shaft excavation, weekly and total progress; Table 8, tunnel excavation, weekly and total progress; Table 9, tunnel excavation, actual and required progress; Table 10, tunnel excavation, cubic yards excavated each month; Table 11, tunnel lining, lineal feet laid to January 1, 1887; Table 12, summary of work completed to January 1, 1887; Table 13, contractors' plant.

In addition to these tables there is a large number of photo-gravure pictures of the work at different points and different stages, of contractors' plant, etc.; also photolithographs of various details of construction, of methods of laying out, of head works at shafts, etc.

THE HEALTH OF NATIONS.*

EDWIN CHADWICK was born January 24, 1800; had his attention specially called to the value of sanitation in 1828; entered the public service as an assistant commissioner for inquiry into the poor-law system; became secretary to the first New Poor-Law Board in 1834, and a member of the Board of Health organized in 1848. In 1854, with the breaking-up of the Board of Health, he retired from active service, and since that time has been busy in writing on matters connected with sanitation and sociology. He is eighty-seven years old, yet within this year we have received from him a pamphlet on the "Elementary Education Question," and another on "Alternative Remedies for Ireland," showing that he is still active, and keenly appreciative of what is going on in the fields in which he is interested. He has been the main starting point of the sanitary work of the present century, and this in two ways. In the first place it is to Mr. Chadwick that we owe the statistical foundations which alone make it possible to put sanitation on a scientific basis. The earlier commissions of inquiry into the sanitary condition of the people of England were largely due to his efforts, and their reports are mainly from his pen. The organization of the system of registration of vital statistics of England is due to his advice. In the second place he has constantly acted as a powerful stimulus and influential guide to other workers by the incessant stream of reports, reviews, addresses, and pamphlets which he has been contributing to the press for over fifty years. Many of these have been anonymous; many have appeared over the names of men who had little to do with their preparation.

The story of his life and literary labors is therefore the story of the development of modern sanitary science, and Dr. Richardson has told the story very well, although in somewhat fragmentary fashion, which was perhaps a necessity. The keynote of all of Mr. Chadwick's teaching is the need for centralization and concentration of effort to obtain reliable data, to secure the best expert advice, and to provide for supervision of sanitary work by persons independent of local interests, and that all this is needed from a business point of view.

Every one who is interested in the social and sanitary problems of the age will find instruction in these volumes, which do not admit of summarization, so wide and various are the fields of inquiry and work which they cover.

* A Review of the Work of Edwin Chadwick. With a Biographical Dissertation. By Benjamin Ward Richardson. 2 vols. 8vo. London: Longmans. 1887.

RECENT SEWER CONSTRUCTION.

No. VIII.

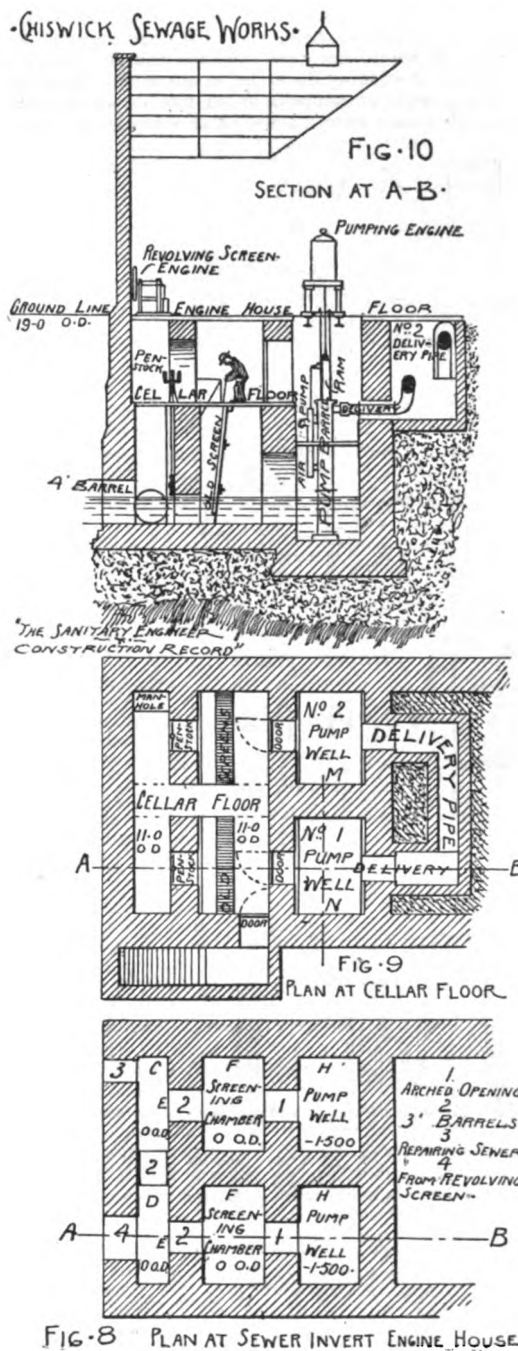
(Continued from page 327.)

CHISWICK SEWAGE-WORKS.

[Prepared for THE SANITARY ENGINEER and CONSTRUCTION RECORD by Joseph Hetherington, Resident Engineer.]

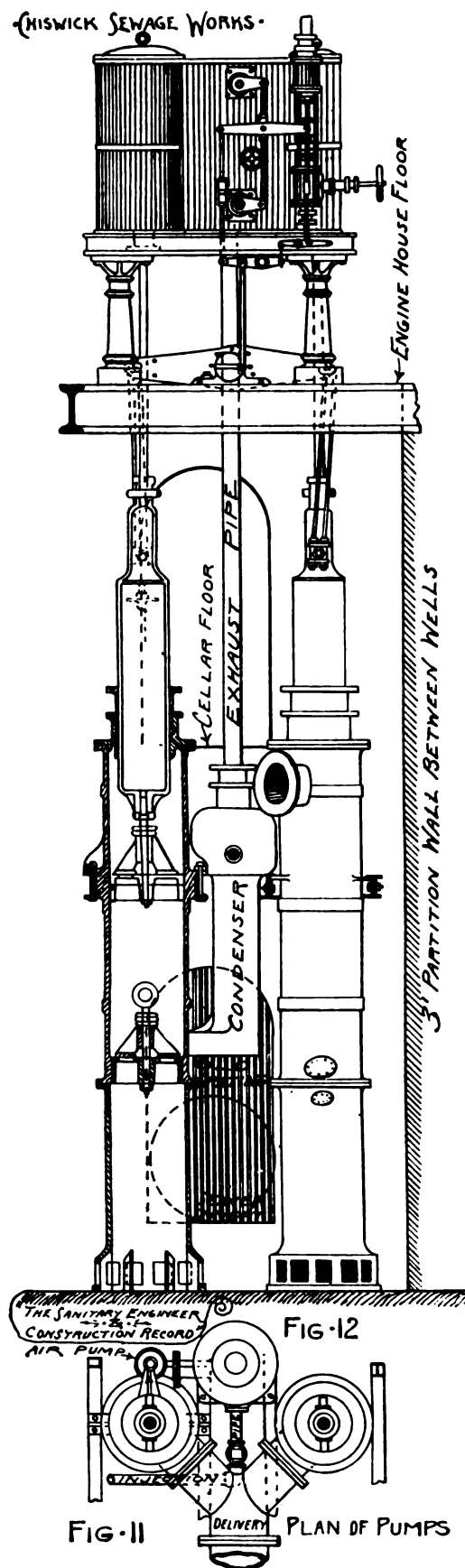
DURING the building of the new screen a temporary sewer was put in to divert the sewage. It is now closed with a penstock, and can be used at any time to divert the sewage when repairs are needed in the screen.

Where circumstances permit, it is desirable to have a bell-mouth both before and behind the revolving screen, so that no corners are left for grit and fine solids to accumulate; but at Chiswick the already existing pump-wells did not admit of this, and, accordingly, a 4-foot barrel takes the sewage from the wheel and conveys it into a chamber C D, Fig. 8, in the basement of the engine-



house. The repairing sewer also enters into this chamber. The chamber C D is divided by a wall, the object of which is not now apparent, as a 3-foot barrel is built in at the bottom of it. Penstocks E E admit the sewage to either or both engine-wells, H H, as may be desired, and on its way it passes through the old screens in the chambers F F, and through arched doorways to the wells, the floors of which are eighteen inches lower than the rest of the basement. A cellar floor is arranged eleven feet from the inverts, and on this the man stood when raking the paper, etc., from the grating. (See Section Fig. 10). The penstock-screws are on this floor and doorways to the pumps. The brickwork is very massive; all the walls are three feet thick up to the cellar floor and are built in cement. About six feet thickness of Portland cement-concrete is put in the foundations, much of it thrown in in bags, as the enor-

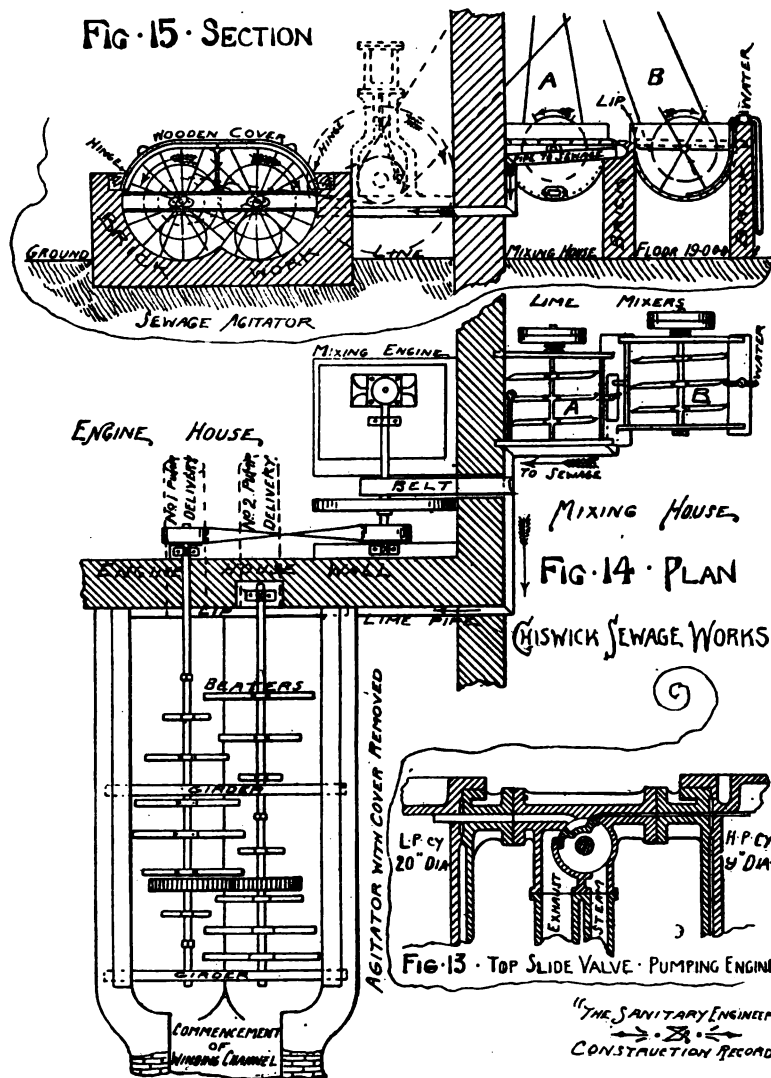
mous volume of ground-water washed the cement out before it had time to set in the ordinary way. The object of the wall immediately in front of the man with the rake, Fig. 10, is difficult to imagine. The wall is pierced with three arched openings, and its only conceivable service is to prevent collapse of the sides of the engine-house. The party-wall between the wells is carried up to the engine-house floor, and affords support for the girders on which the pumping-engines stand.



The engines and pumps are in duplicate and stand side by side and over the wells. This position will be seen from the plans in Figs. 8 and 9. In Fig. 10 the delivery-pipes are shown on their way to the winding channel. A section at M N, Fig. 9, showing No. 1 engine and pumps, is illustrated in Fig. 10, and a plan of the pumps in Fig. 11. The pumps are of the plunger and bucket type, worked by an inverted compound engine overhead. The action is as direct as it is possible to be, as the piston-rods go direct into the plungers. The pump-barrels are carried by girders built into the walls, and the engines on

girders at right angles to the lower ones. The brick-work is thus made an integral portion of the pumping machinery. Where the high-pressure piston is at the top of its stroke, the low-pressure piston is at the bottom, and the steam that is then under the high-pressure is expanded under the low-pressure piston as it makes its up-stroke. Similarly the steam from the top side of the high-pressure is expanded on the top side of the low-pressure piston, the relative positions of the piston being maintained by a light beam underneath, which is connected at each end by long links to the heads of the plungers. The condenser is underneath, between the pump-barrels, and the air-pump is fixed to the left-hand barrel in the figure, and operated by a cross-head on the side of the ram. The distribution of steam in the engine is effected by two circular valves; the top one is shown in section in Fig. 13, and the bottom one is exactly similar, but the other way about. The circular valve-chests are filled with steam, and the valve moving to the left admits steam to the high-pressure cylinder, and from the low-pressure cylinder to the condenser. At the same moment the lower valve shuts steam off the high-pressure piston, and allows the enclosed steam to expand into the low-pressure cylinder. On moving to the right

per minute, equal to lifting about 5,000,000 gallons of sewage with the two engines in 24 hours. Two shifts of men are employed at pumping and treating, but the actual work for one engine is only six hours in each 24 on the average, divided into four spells. There are, therefore, intervals of some hours duration when the flow is stopped, resulting in deposits in the sewers. Flushing-chambers are provided at the head of every sewer, but the immense quantity of filth scoured out by every rainstorm shows that these are unable to prevent the natural result of stagnation. Although the pumps are so much in excess of dry-weather flow, yet rainstorms occur when they are unable to lift the water at the rate it is coming down, and in dealing with the flow, diagrams will be given illustrating this. The storm-overflow can only act when the tide is down, and hence great power standing ready is absolutely necessary. The rational method would seem to be a small pump in addition, capable of dealing with the dry-weather flow when it is at its maximum, and also of being slowed down to the minimum. The sewage would not then stagnate, and the numerous complaints of stinking manholes would cease. Whenever the arrangement of pumps is at all like Chiswick the engine-wells should have a penstock between them, as well



the action of the valves is reversed. Motion is given to the valve-gear in part by the rocking-shaft on which the beam works, and in part by a cataract gear bolted to the side by the high-pressure cylinder. The section of valve in Fig. 13 corresponds to the position in Fig. 12, when the engine would not move at all. But by causing the cataract piston to move either to the top or bottom of its stroke (which can be done at will) the valves may be moved either to right or left, and either piston made to commence with a down-stroke. The cataract gear serves as a governor to the engines. The cylinders are steam-jacketed and covered with wood lagging. Steam is supplied by three Cornish boilers, each fifteen feet long and five feet six inches in diameter. The following are the leading dimensions of the engines and pumps:

Diameter of high-pressure cylinders	9 feet, length of stroke	3 feet.
" low-pressure	20 "	3 "
" pump-plungers	15 "	3 "
" buckets	27 "	3 "
" air-pump	8 "	3 "

The lift is 19 feet from the sewer invert to the floor of the mixing chamber into which the delivery pipes discharge. Each stroke up and down raises 90 gallons of sewage, and the engines can make about 20 strokes

as one between each well and the sewers, so that the sewage could be kept moving through the well of the engine at rest, and putrid stagnation be prevented. A small pump should also be connected to each well to rapidly clear out the water when it is necessary to go below. It is to be hoped, however, that few pumps stand in the sewage as they do at Chiswick, where the arrangement is unnecessarily filthy.

The pumped sewage is delivered into a brick chamber built against the engine-house, where the "milk of lime" is added and mixed with the stream. The milk of lime is prepared in two machines, A and B, to the right of Figs. 14 and 15. These are made of wrought iron, and are kept filled to an overflow lip with water. The water is admitted at the bottom, the lime is added at intervals, and the mixture stirred up by arms fixed to a shaft. By this means a continuous stream of milk of lime is discharged over the lip and conveyed to the chamber outside, where a second lip spreads it over the discharge from the pumps. This chamber is traversed by two shafts geared together, and carrying beaters of wrought iron two inches wide. They are caused to revolve about fifty times a minute, and they thoroughly incorporate the lime with the sewage. By their action the air is also brought into play as a purifier, for the sewage is beaten up into spray in which a rainbow may be observed on sunny days. The agitator outside is covered with wood to prevent splashing over.

(TO BE CONTINUED.)

PAVEMENTS AND STREET RAILROADS.

No. XIII.

(Continued from page 351.)

WOOD PAVEMENT IN THE METROPOLIS.*

Oxford Street, Marylebone Lane to Duke Street, was laid in September, 1876, upon an existing concrete foundation, at a cost of 13s. 6d. per square yard, and offered to be maintained for fifteen years at 12s. per square yard. It was repaired in 1878, and each successive year to November, 1882, when the blocks were removed, and the pavement relaid upon the plain system with a cement joint. The blocks originally were 6 inches deep, and when removed had worn down to about 3 inches, their actual life being about 6.20 years. The average annual wear of wood was 0.484 inch, which, reduced to the traffic standard, is equal to 0.319 inch. The pavement suddenly broke up and went to pieces at the end of 1882, owing, it is stated to water getting underneath, and the asphalt breaking up, which was probably caused by the "open joint" of asphalt and lime grout.

The Strand was paved in February, 1877, the cost being 13s. 6d. per square yard, and maintenance undertaken at 1s. per square yard for twelve years. Six-inch Baltic red blocks were used, and the pavement lasted till 1882, when it was renewed. The actual life of the wood was a little over five years, but it should be observed that the daily traffic is upwards of 1,100 tons per yard width.

Fleet Street.—The eastern portion was paved in July, 1877, the cost being 15s. per square yard. Considerable repairs have been carried out, but it is much worn, more so than Henson's pavement, and is somewhat bumpy to drive over; this may perhaps be partly accounted for by the gradient being sharp. The average annual wear of the wood is 0.456 inch, which, reduced to the traffic standard, is 0.251 inch.

Regent Street.—The portion between Piccadilly Circus and Vigo Street was paved in September, 1880, at a cost of 12s. 6d. per square yard, on a cement concrete foundation, 12 inches thick, formed of 2 parts of old macadam to 1 part of ballast. Six-inch deal blocks were laid, but they already show considerable signs of wear; in fact, they needed repair in 1883. The ascertained annual wear is 0.286 inch, which, reduced to the traffic standard, is equal to 0.384 inch.

Brompton Road.—The eastern part was paved in December, 1878, at a cost of 13s. 9d. per square yard. The blocks have been repaired on several occasions; the surface is in a more uneven condition than Henson's pavement, and the joints are much worn. The life of the blocks may be put at six and a half years. The ascertained annual wear is 0.373 inch, which, reduced to the traffic standard, is equal to 0.431 inch.

The author fails to observe that the asphalt bed and joint passes the merit claimed for them, and certainly the pavement in Brompton Road, the surface of which became irregular at least two years ago, is in an extremely unsatisfactory state, owing no doubt to the failure of the joint and quality of the wood.

Lloyd's patent "keyed" pavement was laid in Pall Mall in February, 1879, and, from the deplorable condition into which it had fallen in December, 1883, there can be little doubt that it has proved an utter failure. Unquestionably the work was carelessly executed, as the author found blocks varying in length from 8 inches to 15 inches, and joints from 1 inch to 2 inches in width; and when it is considered that the blocks were laid diagonally, although the wood used was pitch pine, it is not unreasonable to attribute the failure to the mode of jointing and diagonal form of blocking. The specimen blocks submitted were taken up in December, 1883, and they reveal the fact that the so-called "key" was no key whatever, it having entirely failed to hold the blocks together; and considering the irregularity of the width of the joint and the pooriness of the material with which it was formed, together with the uneven bedding of the blocks, it will be readily understood that the joints soon wore down, and that the blocks became rounded, thereby rendering the pavement uneven and more bumpy to drive over than any other modern system. The pavement originally cost 8s. 5d. per square yard only, being laid on an existing concrete foundation. When the blocks were removed they were about 4½ inches deep, but being so much rounded and unevenly worn, it was found that they could not be turned and relaid; consequently deal blocks upon the plain system were substituted. The life of a large area of the pitch pine "keyed" blocks was, therefore, less than five years—an extremely unsatisfactory result, especially when it is remembered that the carriage-way is extremely wide.

The same system of pavement was laid in the upper part of Regent Street in September, 1880, at a cost of 13s. 9d. per square yard. It was repaired in 1883, and again this year; it already shows considerable wear, and is uneven in places. The blocks are of pitch pine, 6 inches deep, and the ascertained annual wear is 0.214 inch, which, reduced to the traffic standard, is equal to 0.288 inch.

The pavement known as Carey's system was laid in Cannon Street in September, 1874, at a cost of 13s. 6d. per square yard, the maintenance terms being two years free and fifteen years at 1s. 6d. per square yard per annum. The blocks originally laid were 4 inches wide by 9 inches by 6 inches, and were shaped with alternate convex and concave ends, and laid on a thin bed of ballast, the joint being formed of lime grout. Considerable repairs and renewals have been carried out from time to time, and in

*A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

March, 1884, the author saw several trenches opened near Queen Street, at which places the original blocks had worn to a depth of 3 inches, the surface being extremely uneven, not to say bad. The western section, which was renewed about a year ago, is already uneven, and begins to show signs of wear, and notwithstanding that the wood has considerable durability, yet, owing to the inferior surface of the pavement, the author would hesitate to class it among successful pavements.

The ligno-mineral pavement was laid throughout Coleman Street, City, in June, 1865, at a cost of 13s. 6d. per square yard. The paving consisted of mineralized pitch-pine blocks, 4 inches deep, with a "mastic" joint, the top portion being lime grout. The pavement having become worn out, owing to open joints and decayed wood, it was taken up in April, 1882, when asphalt was substituted. It is extremely probable that in consequence of the carriage-way being so much in the shade, the wood was specially liable to retain moisture. Fore Street was similarly paved in December, 1874, but the wood was replaced with asphalt in July, 1883.

Messrs. Moulem & Co.'s Pavement.—This plain system of paving has been laid in various parts of the metropolis, particularly in the city, St. Giles, St. Marylebone, St. Pancras, and Kensington. In Princes Street, Cavendish Square, blocks which were laid in September, 1874, are still in existence.

Kensington High Street.—In May, 1877, a section was laid near the Vestry Hall, at a cost of 14s. per square yard, with a three years' free maintenance. Six-inch blocks were laid in their natural state, with a ½-inch joint of lime grout. The present depth of the blocks is stated to be 3 inches, the annual average wear therefore being 0.440 inch. The surface shows considerable wear, and after rain water is retained at those points where it has worn below the channel-level. The latter evil is possibly to be attributed to the very slight rounding, one inch in four feet, to which it was laid. The blocks are to be renewed in October next, when the life of the wood will have been seven and a half years.

Fulham Road, Sydney Street to Arthur Street.—This section was paved in July, 1878, at a cost of 14s. per square yard, and in other respects was similar to the last-mentioned pavement. The surface is considerably worn, and the form of joint not only retains dirt but tends to round the blocks, the average depth of which is 4½ inches, or equal to an annual average wear of wood of 0.242 inch. The pavement will probably be relaid in 1885, when its life will have been seven years.

A large area of "plain" wood pavement has been laid in Kensington by Messrs. Nowell & Robson, who paved Kensington Road, Fulham Road, Uxbridge Road, and High Street, Notting Hill. The last-mentioned street was carried out in December, 1878, at a cost of 12s. 6d. per square yard, with a three years' free maintenance. The lime-joint gave much trouble shortly after the work was completed, and in places it may be observed that it has allowed dirt to accumulate. The average wear is equal to 0.218 inch per annum.

In other metropolitan districts besides Chelsea the local authorities have successfully laid a plain system of wood pavement by means of their own staff of workmen, particularly in St. Marylebone and Paddington. The credit of introducing this method is due to the St. Marylebone vestry, whose first work consisted in paving the portion of Oxford Street east of Regent Circus, in October, 1878. The blocks were laid upon an existing concrete foundation, and the work cost 8s. 4½d. per square yard, exclusive of the removal of the old stones. The blocks were repaired in 1882, 1883, and in 1884, at an approximate cost of 6d. per square yard. Plain yellow deal blocks, 6 inches deep, were adopted, with a cement-joint ½ inch wide, and they have worn to an average depth of 3.30 inches, but in some parts of the street the thickness is 1½ inch only. The surface shows considerable wear, and is uneven in places, the wood being so remarkably thin near the rests that it is a mere crust. The probable life of the wood is six and a half years. The average annual wear is 0.475 inch, and if reduced to the traffic standard it is equal to 0.306 inch. The heavy rate of wear is probably owing to the width of the joint, the author having taken up a piece of grout ¾ inch thick. This irregularity would have been avoided by the use of iron studs instead of temporary strips or latins. A large area was similarly laid in Edgware Road in October, 1880, and at the same cost. The surface is good; the annual wear is 0.198 inch, and if reduced to the traffic standard it amounts to 0.254 inch.

The Paddington vestry have laid 125,232 square yards in various streets. Praed Street was paved in July, 1879, with 6-inch plain yellow deal blocks, at a cost of 10s. 7d. per yard, and the surface is in a fairly good state. At the eastern end the blocks have been repaired on several occasions, the present depth of wood in the centre part being 4 to 4½ inches.

Generally speaking, the plain system appears to have given satisfaction, but the mode of jointing with lime-grout, or a wider joint than ¾-inch, cannot be recommended. Upon inspecting the lime-joint after a few years' wear, it may be ascertained that it wears below the surface, that dirt accumulates in the joints, and that the blocks have either become rounded or the top edges "burred," to such an extent that the surface has become bumpy. The lime-joint gave trouble when newly laid in Notting Hill in December, 1878, as after a sharp frost the grout, so to speak, "spewed" up, the rain filled the joint, and considerable sections of the pavement were literally afloat until the defects were remedied. A system

of blocking, which the author considers objectionable, is that by which the blocks of a new pavement are laid upon fresh unset cement floating, and, as the grouting is proceeded with, the blocks rammed with a "pavior's" rammer, so as to obtain a smooth surface. Under this process there is a probability of the blocks being injured or split, apart from which it is found that when the time arrives for renewing the wood, the surface of the concrete contains a series of indentations instead of being smooth and even. The difficulty may of course be surmounted by chipping off the projecting parts and refloating the surface, but the repaving cannot be so expeditiously or economically carried out. The result of the author's experience and investigation induces him to submit (1) that the surface of the concrete foundation should be perfectly smooth and fully set before the blocking is proceeded with, and (2) that a carefully-made cement-joint ¾-inch wide will not only be found simple and watertight, but will prove as durable as the wood itself.

Cost.—With the exception of a small area, the whole of the wood pavement in Chelsea, about 50,000 square yards, has been laid by the Board's own staff. The estimated cost of the pavements in King's Road and Sloan Street was 11s. 3d. per square yard,* but, as previously stated, the actual cost amounted to 10s. 6d. per square yard, exclusive of £120 spent in the before-mentioned experiments. The pavement in Fulham Road cost 10s. 3d. per square yard, the difference being partially attributable to the fact that a portion of the old broken granite was used in the concrete foundation in lieu of ballast.

The details of the cost per square yard, are as follows—viz.:

ITEM	31,313 yds. in Sloan Street and King's Road in 1879.	10,573 yards in Fulham Road in 1881.
Labor in breaking up macadam surface and excavating.	11.00	11.00
Cartage of old materials, including shoot for rubbish.	9.04	9.80
Portland cement for concrete and grout.	20.02	17.17
Thames ballast and sand for concrete, grout, and top dressing.	8.56	5.80
Blocks.	58.66	60.82
Studs.	1.58	1.48
Labor in bottoming up and leveling, preparing, and laying concrete, fixing studs in, wheeling, and laying blocks, grouting, top dressing, watching, and sundries.	13.45	14.12
Labor and materials in permanently filling in margins.	0.86	0.90
Sundries—plant, tools, superintendence, testing cement, oil, repairs, etc.	2.92	1.85
Total.	126.09	122.94

NOTE.—No allowance is made for the value of the paving stones and broken granite taken up and reused in other parts of the district, the minimum value of which amounted to £2,050, or about 1s. per square yard.

The variation in the prices paid for wood pavement in various parts of the metropolis has been somewhat remarkable, the maximum cost per square yard for laying a pavement and concrete foundation with entirely new materials having amounted to 18s. 6d., and the minimum to 10s. 6d. Owing presumably to competition and to the experience which has been gained, together with increased facilities, the cost has gradually been reduced to reasonable limits, as compared with the charges made eight or nine years since.

Management.—However excellently a street carriage-way pavement may have been constructed, its condition will soon become unsatisfactory unless its maintenance receives proper supervision. Good management implies not only that repairs shall be promptly and efficiently executed, but that the services of cleansing, watering, and sanding must be properly carried out; in short, the essentials of proper management are to be found in the judicious application of the scraper and broom, of water, and of grit, and in the immediate removal of defective blocks. The reinstatement of gas, water, and drainage-trenches must be classed under the first heading; and, although an apparently small matter, yet from the frequency of such openings, so serious an interference with the street surface is created, that in the course of a few years surface uniformity cannot be maintained unless this work is very carefully executed, and ample time allowed to elapse before the traffic is allowed to pass over the work. After a pavement has been laid for three years the existence of defective blocks becomes apparent, as by this time, the first effect of compression having ceased, the fibres of such blocks begin to yield under traffic pressure, with the result that slight surface depressions are formed. When this happens a bumping motion is created, and as the wheels then strike upon upon the edges of the adjoining blocks it is obvious that the surface must become irregular; and depressions or hollows a foot square or more are soon formed, which, unless promptly remedied, materially spoil the surface.

To avoid slipperiness and to insure many of the advantages claimed for wood pavement, it is essential that a thorough and systematic service of cleansing must be carried out, especially where macadam pavements are contiguous to wood, as in damp weather a considerable amount of mud is imported from them. In connection with the wood pavement in Chelsea there is a regular street orderly service, by which horse-droppings are removed and deposited

in bins. In addition thereto the wood pavements are washed once or twice a week, and are cleansed daily either by horse-sweeping machines or by hand labor. In the absence of heavy rains mere sweeping fails to keep wood pavement clean, and washing then becomes essential. To effect this water-vans are sent out before midnight, and the surface is so thoroughly soaked that, by the time the sweeping machines commence to work at 3 A. M., the dirt is easily removed, the entire operation being concluded in the forenoon. The ascertained cost of this service, including labor and horse hire in washing and sweeping, street orderly work, and collection and removal of the sweepings, amounts to 4½d. per square yard per annum, as against 11d. per square yard for macadam previous to the substitution of wood. It has been asserted upon good authority that the cost of cleansing wood pavement is very trivial; this is slightly misleading, the proportions being approximately:

Macadam	1.00
Wood	0.41

Theoretically, the amount of mud created upon the surface of wood, as also in the case of asphalt, should be almost nil; but practically the author finds that some 2,700 cartloads are annually removed from a length of about three miles in Chelsea. Therefore, after making every allowance for the conversion into mud of 350 loads of sand placed on the wood when slippery, it is obvious that a great portion of the mud is imported from the adjacent macadam.

The plentiful application of water prior to the work of cleansing is most beneficial, both in preventing dust, and, from a sanitary point of view, in removing the cause of obnoxious smells; but as the metropolitan water-supply is not yet in the hands of the ratepayers, its use for this purpose is materially restricted. The author ventures to assert that the system of cleansing thus described is amply sufficient to obviate slippery surfaces caused by the accumulation of greasy mud, and that the summer watering may be so carried out that a minimum wetting will suffice to keep down the dust. Letters have recently appeared in the *Times* with reference to the watering and cleansing of wood pavements, in which it has been strongly urged that such pavements should not be watered at all. When it is considered in what an unskillful manner street-watering is sometimes done, and that, owing to the stupidity or carelessness of carmen, considerable danger to locomotion is caused by overwatering a dirty pavement, there may be some justification for the contention. Doubtless horses travel better on dry wood pavement than on a watered surface, but in the absence of rain, watering is an absolute necessity for keeping down fine dust, more especially upon a hot windy day, when at least five or six wettings are required. Watering is also necessary for the preservation of the wood itself, as without water it would be materially injured by abrasion under such conditions. It is also questionable whether the very fine dust which must be given off under a non-watering system, would not become so serious as to be injurious to health and promote disease of the eye; but apart from this, the nuisance from the heat and dust combined would become intolerable.

In continuous damp and foggy weather and on frosty nights wood pavement is especially liable to become slippery; therefore, to insure a safe foothold for horses, its surface should be covered with a thin layer of Thames sand or grit. In Chelsea it has been found that this operation can be more expeditiously and evenly carried out by horse-machines known as "sand-distributors" than by manual labor alone. Night gangs have been organized, and, according to the conditions of the weather, the machines are sent out either at night or early in the morning; in the latter case the whole of the wood is sanded and made fit for traffic by 8 o'clock. The operation is beneficial to the wood itself, and might be advantageously carried out at other times, because the grit becomes so well worked into the ends or fibres of the blocks that it not only affords protection to them, but insures a better foothold for horses. The ascertained cost of the sanding does not exceed ½d. per square yard per annum.

(TO BE CONTINUED.)

SIXTH ANNUAL REPORT OF THE WATER COMMISSIONERS OF AMSTERDAM, N. Y.

THIS report, prepared by Mr. A. H. Degraff, Superintendent and Engineer, shows the present state of the works to be as follows: Total cost to date, \$371,221.52, with bonds outstanding for \$257,000. Expense account for the year (net), \$20,964.26, including \$2,921.80 for construction account, and receipts \$22,465.34. There are now 76,089 feet of distribution pipe in use and 2,050 were laid during the year. There are 130 hydrants, 196 gates, and 37 meters. The amounts metered varied from 6,508 gallons for the year to over 13,000,000 gallons, or an average of 128,770 gallons per day and an income of \$10.81 per day from meters.

The average cost for 864 feet 4 inches and 1,905 feet 6 inches pipe laid, including pipe, special castings, 7 stop-gates, six 4-inch and one 6-inch hydrant, freight handling, trenching, and back-filling, was 95 cents per foot.

In the autumn of last year the water was drawn down nine feet in the reservoir, and this with the proposed sewerage system makes an enlargement of the works necessary. Two plans are suggested, but the second, which proposes a large storage-reservoir on the creek above the present distributing reservoir, is recommended.

* Minutes of Proceedings Inst. C. E., vol. lviii., p. 75.



ENGLISH PLUMBING PRACTICE.

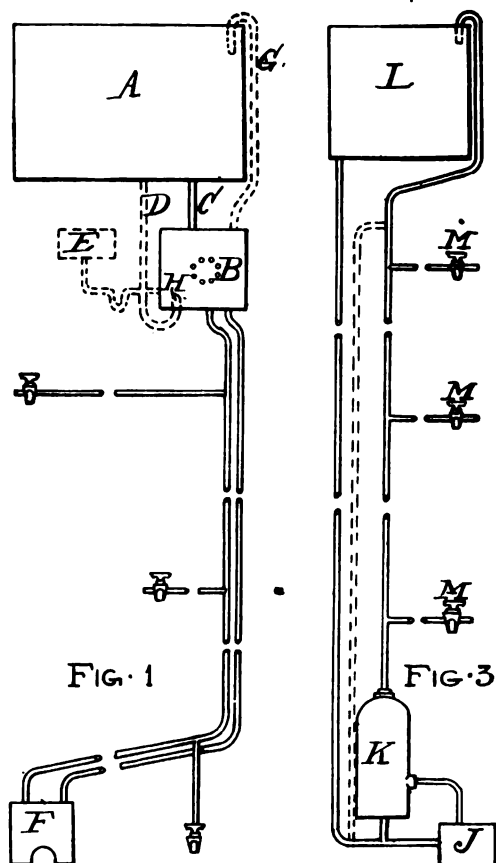
BY A JOURNEYMAN PLUMBER.

No. LXVII.

(Continued from page 139, Volume XV.)

HOT-WATER FITTINGS.

AFTER the boiler is properly fixed the next thing is to consider the circulation-pipes. Figure 1 is a sketch diagram showing how they are fixed in some of the London jerry-built houses. The pipes are usually of $\frac{3}{4}$ -inch bore, and of the gas-pipe description, which is very light in substance. The bends are often carelessly made and buckled in their throats, so as to offer serious impediments to the free flow of water through them. The pipes are rarely coated inside, or galvanized, to prevent oxidation, with the result that frequently all the hot water has to be run to waste, as it is so highly colored with iron rust. In some slightly better houses 1-inch bore pipes are used.



and in first-class work it is usual to fix $1\frac{1}{4}$ -inch galvanized iron or tinned copper pipes. The iron is what is called the lap-welded steam-pipe, and is very strong. The copper pipes have a lapped and brazed seam, but the last few years a great deal of patent seamless drawn copper tube has been used. Copper pipe should always be tinned when quite new and bright. When kept in stock for some time before being tinned, it is often found that the inside, which cannot be seen, do not get coated over the entire surface, patches of copper being left untinned.

Referring again to Fig. 1, A is the cold-water and B the hot-water cistern. C is a pipe connecting the two. The writer has frequently met with this stupid arrangement. In some other cases the feed-pipe has been connected as shown by dotted lines at D. Both of these arrangements are bad, as the hot water will sometimes work back into the cold-water cistern, rendering the contents into a heated state. This evil is more serious when the cistern A has to supply cold water to the sinks, etc. This can be prevented by fixing a light flap or valve on the end of the connecting pipe, as shown at H, Fig. 1, but, as this valve is liable to set fast, it is not a good plan.

In some cases a small feed-cistern is fixed at the side of the hot-water cistern, as shown at E, Fig. 1. This is a better arrangement, as it breaks the direct communication between the cold and hot water cisterns, but the blunder

is frequently made in fixing a $\frac{1}{2}$ -inch—in some cases a $\frac{3}{8}$ -inch—ball-valve in the feed-cistern. There is some little risk of damage to the boiler attending this arrangement. The low head of pressure on and the smallness of the ball-valve allows the water to dribble in very slowly, so that if a tap is left running, say into a bath, and another tap is opened at a level with the boiler, it is possible to empty the cistern-pipes, and boiler; and it need scarcely be added this is a very dangerous thing to do when the boiler fire is alight.

In some cases the draw-off taps have not been connected with the circulation-pipes, but to a separate pipe fixed from the hot-water cistern. This is not to be recommended, as in the case of a high house a long length of pipe would have to be emptied of the stagnant cold water contained in it before hot water could be drawn. And again, the pipe would have to be connected to the upper part of the hot-water cistern, the lower strata of water being often quite cold. This would limit the available supply of hot water. The writer has seen a few cases where the feed-pipe was fixed direct from the cold-water cistern to the boiler. In one case the pipe was only $\frac{1}{2}$ -inch in bore, which was much too small. The feed-pipe should always be so large that the cold water will run in as fast as the hot water can be drawn off.

Hot-water cisterns generally have steam-tight covers, or manholes, and have a pipe fixed from the top to the outer

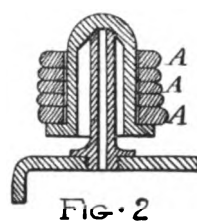


FIG. 2

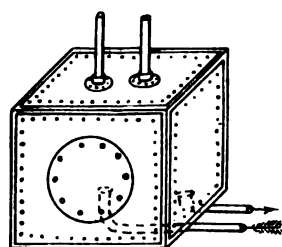


FIG. 4

air above the level of the cold-water cistern. In some cases this, what is commonly called expansion-pipe, is turned over the top edge of the cold-water cistern as shown at G, Fig. 1. In one case the writer saw several years ago, when the cold-water cistern was full the water covered the end of the expansion-pipe and the connection thus made created a circulation between the water in the two cisterns.

It is very important that all pipes connected to a boiler should be kept free from any stoppage, or a possibility of the water being frozen. There is no more frequent cause of boilers bursting than pipes being frozen. In some cases a patent plug, with a thin disk of copper in the centre, regulated to break when an extra pressure has been brought to bear, has been attached to the boiler. In other cases a safety-valve has been attached. Some of the safety-valves are similar to those usually attached to steam-boilers. Another kind much used is called a "dead-weight safety-valve," and is shown in section at Fig. 2.

The top of the inner tube is conical and ground into the outer cap. Weights A A A are added in proportion to the pressure the valve has to resist, care being taken not to add more than is really necessary. This valve should always be connected with the boiler by means of a separate pipe. If connected with the circulation-pipes, as is sometimes done, and common keyed bibb-faucets are used for

drawing off hot water, water-hammer in the pipes, caused by sudden closing of a cock, will sometimes cause the safety-valve to jump, so to speak, and allow a small quantity of water to leak out. This kind of valve is a very good one, and is preferable to some that have the weights piled on the top, making them top-heavy and more likely to leak if they should be knocked against or jarred.

It is an open question if safety-valves are to be trusted in cold countries, as it is possible the valve itself may become fixed if the water inside gets frozen.

Fusible plugs are sometimes fixed to boilers, so that if by any means, such as shortness of water or insufficient supply, they become empty when the fire is burning, the plugs will melt and thus relieve the pressure brought to bear by the sudden expansion of water into steam should it come in when the boiler is hot.

In first-class houses of modern construction the old way of fixing the hot-water cisterns at the top of the house, or on an upper floor, is not so generally practiced, but what is known as the cylinder system has been adopted.

Figure 3 is a sketch diagram showing one of the simplest arrangements as fixed in some of the middle-class houses. J is the boiler, K the hot-water cylinder, L the cold-water cistern, and M M M the draw-off cocks. In this system the water circulates between the boiler and cylinder and a pipe is fixed from the top of the cylinder and continued above the cold-water cistern. From this pipe branches and draw-offs are fixed in the various positions as necessary. The only drawback to this system is, that the water in the rising pipe being stagnant, and at times nearly cold, it has to be drawn off before hot water can be had at the cocks. In some cases a return-pipe has been fixed as shown by dotted lines, and as it was only necessary for the water to circulate slowly, this return-pipe has been fixed of a smaller size than the flow-pipe. For best work the return should always be the same size as the flow pipe, or the circulation of the hot water is very much impeded.

In some cases the hot-water chamber has been made of iron plates riveted to angle-irons, and made as shown in sketch, Fig. 4. But even when made of $\frac{1}{4}$ -inch iron plates it has been found necessary to have several stay-ropes inside to prevent the sides and top bulging out by the internal pressure. This bulging sometimes causes the joints of the pipe connections to leak, and it is nearly always the case that the manhole leaks. This manhole must, of necessity, be large enough for access for cleaning out the chamber, which is rendered more difficult by reason of the complication of stay-ropes inside.

The manhole-plate is of wrought iron and bolted over the manhole with a series of bolts tapped and screwed to an inside strengthening plate. Should the manhole-plate require to be removed for cleaning-out purposes, the bolts are generally difficult to get out by reason of their having rusted in. Sometimes the bolts break off and have to be drilled out, necessitating new bolts and retapping the holes for them. It is very rarely done, but it is better to have gun-metal or copper bolts instead of the iron ones.

(TO BE CONTINUED.)

SCHOOL-HOUSE AIR.

THE annual report of the Public School Department of the City of Hoboken, N. J., for the year ending April 30, 1887, contains a table of analyses of the air made in various school-rooms by Professor A. R. Leeds, upon which the Board of Education remarks that "while the sanitary condition of our schools is probably as good as the average of those of the neighboring cities, still the bad condition of the air in most of our class-rooms, as determined by Dr. Leeds' investigations, demands our earnest consideration and study," which is undoubtedly correct.

Taking the average proportion of carbonic-acid gas in the air of the streets, as found by analysis to be four parts in 10,000. Professor Leeds found that in School No. 1, in five class-rooms, it ranged from 15 to 29, in School No. 2 from 12 to 21, and in School No. 3 from 10 to 26 parts in 10,000. It is no wonder that in his remarks we find such notes as "Air of room unpleasant," "Air very close and disagreeable," etc.

In School No. 4 mechanical ventilation has been applied with benefit, as shown by the fact that in this school the proportion of carbonic acid ranged from 7 to 15 parts per 10,000. The cubic feet of air-space per scholar in the thirty-five class-rooms reported ranged from 265 to 65, being less than 100 in seven of the rooms. Such overcrowding as occurs in these seven rooms is utterly unjustifiable in a school-room under any circumstances.

HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. IX.

(Continued from page 324.)

LOSS OF HEAD OR PRESSURE BY ELBOWS OR BENDS.

THE loss of head in an elbow or bend should be divided into three parts in a study of the subject: (1) That due to change of direction of the water alone; (2) that due to friction alone, the same as in any pipe; and (3) that due to eddies and enlargements or contractions of the currents, such as exist when common screwed elbows are used that have pipes with square ends within them forming sharp shoulders against the current.

The *first* applies to all bends whose radius is less than five times the diameter of the pipe; but when the radius is five times or greater, with smooth bends the loss of head for change of direction becomes so small it may not be considered, as it practically becomes nothing.

The *second* (friction against the sides) applies to all bends, and, in fact, to all pipes, etc., without regard to shape, and it must always be considered as equal to the head consumed by the same length of straight pipe of the same diameter and character.

The *third* applies only to cases where the diameter of the bend or elbow is larger than the diameter of the pipe and has shoulders and threads, and it is greatest with square-ended pipes and least with pipes whose point of entry is easy, with the edges cut to a knife-edge and the angle of the side about as shown by Fig. 19½, and it does not exist at all in smooth bends of equal diameter throughout.

The *second* and *third* quantities, above mentioned, also apply to straight-screwed couplings or sockets and tees and

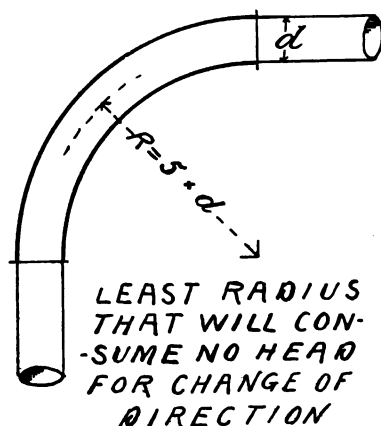


FIG. 21.

in them has about the same value as in elbows; but couplings being straight, of course, there can be no loss for change of direction.

The loss of head for change of direction alone in elbows differs with the angle. Weisbach's formula is the one most used, but it is difficult of application by practical men, and was presumably founded on the loss of head in fairly smooth bends in large water-pipe. If we had special fittings for hot-water work, somewhat like the Durham Co.'s special fittings for wrought-iron soil and waste pipes, in which the square ends of the pipes screwed against shoulders in the fittings, and with the diameter of the elbow or tee no greater than the pipe, then we could with considerable accuracy determine the loss of head by a bend or elbow, as we would have little more than change of direction and friction to consider; but with our present common elbows and tees reasonable approximations only can be formed. The late Robert Briggs was of the opinion that a common elbow (90 degrees), with a radius of about three-fourths the diameter of the pipe, would use as much of the head for change of direction as a pipe of the same nominal diameter thirty-eight diameters in length would use in friction while passing the same quantities of water or other fluid.

Deductions from the tables of Mr. Thomas Box also seem to confirm this, for what he calls "quick bends," or ones whose radii are about 1½ diameters of the pipe, or double the radii assumed by Mr. Briggs, give a resistance of about ¼ only (for change of direction) of what Mr. Briggs finds, and as this very nearly represents the ratio in which the resistance should decrease as the radii increased, we may reasonably assume that our common elbow will not use more head for change of direction than would be used by friction in 38 diameters long of the same pipe, and that this is the maximum. When the bend has a change of

direction of 45 degrees, or only one-half of 90, then the loss per change of direction is only half.

It might be well to mention here that though the loss for change of direction in two smooth 45-degree bends only equals the loss in one 90-degree elbow that the total loss in two ordinary 45-degree elbows is much greater than in

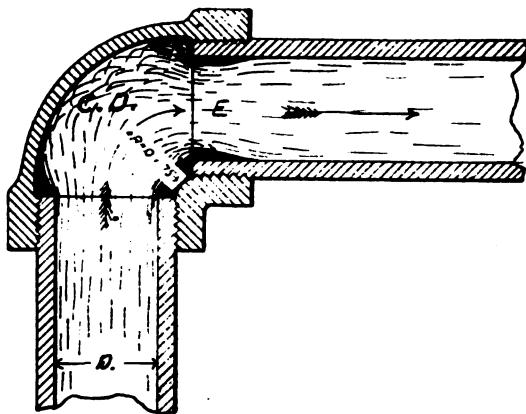


FIG. 22.

the one of 90 degrees, on account of the enlargements and contractions of the currents and the square ends of the pipes that a greater loss ensues from the nipping of two 45-degree elbows together than with one common elbow of 90 degrees.

The *second* division of the loss of head by elbows relates to friction only, and in that case the length of the bend through its centre line is taken and treated as so much straight pipe only.

The *third* division of the head lost by elbows is, as before stated, on account of the enlargement of the current when it enters the elbow and its subsequent contraction again to enter the pipe as it flows along.

There appears to be no question but that we should consider the action of the water in an enlarged bend nearly the same as when it leaves the boiler, and that a fresh point of entry, with its attendant loss, occurs each time. With favorable points of entry this third division of the head that is lost or consumed may be very much reduced, but with square ends there is as much of the head lost as is equivalent to ½ of the heads given in Table II., and this with very low pressures, such as is to be found in hot-water apparatus, is considerable.

On this subject Mr. Briggs considered that as much head was used at entry as was used by 58 diameters of the pipe, and about the same deduction may be drawn from a study of Mr. Box's tables for small diameter pipes.

If from all this, therefore, if we are led to take the extreme view of all the conditions, we are then bound to consider that a short common elbow uses as much head as 38 diameters of the pipe for change of direction alone, and that for entry, with ordinarily fitted square-ended pipes, we must add 58 diameters more, and it points to the fact that the total loss of head from all causes in a common elbow must be about equal to the loss from friction in 100 diameters long of the same pipe; at which rate a 2-inch elbow will consume as much head as 200 inches, or 16½ feet, of 2-inch pipe passing equal quantities of water.

This, of course, is a very extreme view of it, and the rule certainly will not hold true with large diameter pipes, though presumably we can apply it to all pipes smaller than 4 inches with common elbows.

With such diameter pipes and elbows as we ordinarily have to deal with in a heating apparatus, however, if we accept this as correct, we will be probably on the safe side and have something to spare when the radii of our elbows are no less than the three-quarters the diameter of the pipe (say a common elbow).

As the radius increases, however, the resistance decreases, so that in an elbow of 5 diameters radius, but otherwise a common screwed elbow, we have only the resistance to the entry of the water into the pipe, plus the loss by friction, to consider, which reduces the head consumed to be equal that lost by a straight pipe 62 diameters long.

If, on the other hand, we have a short common elbow, and take the trouble to ream the pipe ends carefully, we will then have (1) a resistance equal to the 38 diameters of the pipe for change of direction; then, in consideration of our easy point of entry, the latter (2) may be reduced very much below the value of 58 diameters given to it by Mr. Briggs, so much so that in thick pipes it may become practically nothing, and probably reducing the *total* resistance to less considerable than a pipe 50 diameters long will

give; as a perfect-shaped point of entry would reduce it to 38 diameters—plus something for friction, which even in a common elbow is less than four diameters of pipe will cause. Should the elbow be an ideal one, however, as shown in Fig. 21, then the first factor (for change of direction) is reduced to practically nothing, and the second is done away with altogether, so that friction alone remains and the resistance then is 7.8, or the length of the bend in diameters of the pipe, which reduces it to the same value as so much straight pipe.

To make this more comprehensive, we will make several diagrams of elbows and pipe, giving each part its value in diameters, and by diameters we mean the amount of head that would be consumed by a straight pipe one diameter long.

Let Fig. 22 be a common elbow with a radius of three-quarters the diameter of the pipe ($R = D \times .75$) with square-ended pipes entering it as shown. Then we will have 38 diameters for change of direction (C D) + 58 diameters for entry (E) + 4 diameters for friction = 100 diameters, as the value of an elbow joining pipes as in Fig. 22.

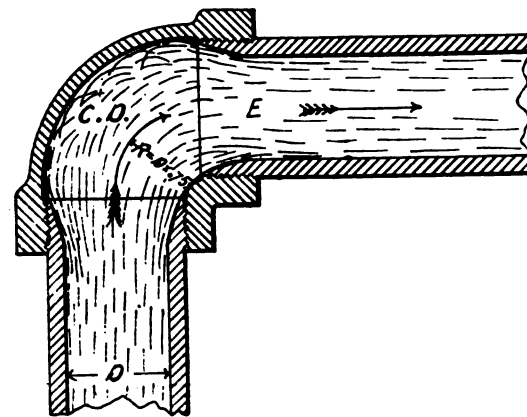


FIG. 23.

Let Fig. 23 be a common elbow, with a radius of three-quarters the diameter of the pipe—same as in Fig. 22—but with the ends of pipes entering it carefully reamed to an easy entry with a reamer, as shown in Fig. 19½ (last article); then we will have for a change of direction (C D) 38 diameters + nothing (or nominally nothing), for entry (E), + 4 diameters for friction = 42 diameters. If the pipe is not thick enough to ream until it gives the proper depth of easy entry, why, then, we must use our judgment and add something to the 42 diameters, and as the roughness of some uncovered threads in the fittings will always play some part in adding to the resistance, we may, perhaps, be justified in calling the value of Fig. 23, as a whole, 50 diameters.

The subject of Elbows will be continued next week.

(TO BE CONTINUED.)

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

PRESSURE-REGULATOR.

THE accompanying cuts illustrate a novel fluid pressure-regulator lately patented by W. B. Mason, of Boston, Mass.

The object of the apparatus, which is well known to engineers, is to prevent the rise of pressure above a predetermined maximum amount, and which is less than the pressure on the boiler side of the valve.

The improvements consist in the novel details of construction and arrangement of the parts employed, by which it is claimed the instrument is rendered more positive and certain in operation than others of its class generally in use, the prime object being to produce a valve that when in operation it will come into equilibrium in the position at which the amount of fluid flowing through should maintain it.

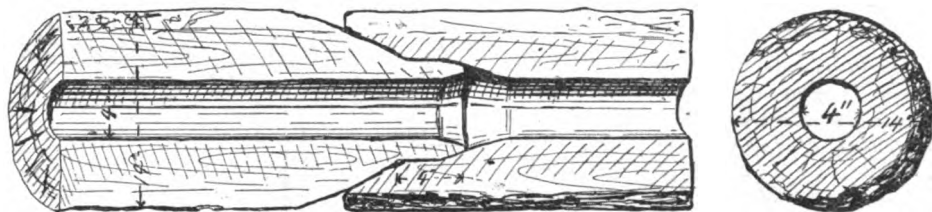
The valve is caused to move in each direction by fluid pressure, and not in one direction by a spring or weight, and in this is its principal difference.

Figure 1 is an elevation, partly in section, the parts being shown in the position assumed when no fluid is acting thereon; Fig. 2 is a longitudinal section on a plane at right angles to the plane of projection of Fig. 1.

The main body or valve-shell *a* of the instrument has the usual inlet and outlet openings, separated by a partition, which divides the shell into inlet and outlet chambers, and is provided with the passage or opening that connects the chambers, and which forms the valve-seat for the valve proper, *b*.

The valve when unseated is acted upon at its upper side by the pressure of the fluid in the inlet-chamber of the valve, and at its under side by the smaller pressure of the fluid at the outlet side of the valve, so that there is a tendency to seat the valve by the fluid-pressure acting upon it.

The valve-shell is provided with an extension below the outlet portion which is in free communication therewith. This extension forms a cylinder for the valve-actuating piston *c*, which is connected with the valve-stem, and is of greater area than the valve *b*, the proportion of these areas being about two to one. The upper surface of the valve-piston *c* is therefore exposed to the pressure of fluid in the outlet-chamber of the valve, which pressure acts in the opposite direction to that on the under side of the valve *b*, and is of substantially the same amount per unit of area, and consequently has about double the force tending to move the valve, so that the tendency of the pressure in the outlet portion of the valve acting on the upper surface of the piston *c* and under surface of the valve *b*, like that in the inlet-chamber acting on the upper surface only of the valve *b*, is to close the said valve.



Sections Showing Wooden Pipe Laid in N.Y. 85 Years Ago by the Manhattan Co.

The inlet-chamber of the main valve-shell is provided with a cap, containing a secondary or governing valve, *e*, controlling a port or passage, *f* (see Fig. 1), that connects the inlet-chamber with the cylinder, below the valve piston *c*. The stem of the valve *e* is acted upon by a spring *g*, connected with the valve-shell, the said spring *g* acting on a head or bearing-piece, resting on a diaphragm, *i*, directly over the upper end of the valve-stem, *e*, so that when unbalanced the spring forces the valve-stem and valve downward until the diaphragm and head come to a bearing on the upper end of the cap, as shown in Fig. 1, opening the valve *e* and permitting the fluid to pass from the inlet portion of the valve-shell through the port *f*, into the cylinder, where it acts on the under surface of the piston *c*. The valve *e* is kept up against the under side of the diaphragm *i* by a light spring. A pressure-chamber, *k*, is formed in the upper portion of the valve-shell, between the cap and the diaphragm, the under surface of which latter is thus exposed to whatever pressure may be in the chamber *k*, which pressure

pressure of which is to be regulated, and the spring *g* is so adjusted that when the pressure of the fluid to be regulated rises to the desired amount, the said pressure in the chamber *k*, acting on the under side of the diaphragm *i*, will be sufficient to overcome the force of the spring *g* and move the head far enough to permit the valve *e* to close.

The pressure of the spring *g* may be regulated and adjusted by a follower, acted upon by an adjusting device *n*, shown as a screw.

The dash-pot or cushioning piston connected with the valve is to prevent sudden movement, so that the valve will not chatter on its seat.

If the apparatus is used with a non-condensing fluid or gas, the dash-pot *p* may be filled with a liquid, or the regulating-piston *p'* have a tighter fit, so as to cushion on the gas.

THE MANHATTAN CO.'S OLD WOODEN WATER-PIPES ON BROADWAY.

WHILE the workmen of the Phoenix Construction Co., of No. 18 Courtland Street, New York, were opening Broadway on the west side between Courtland and Dey Streets, for the construction of the Consolidated Telegraphs Electrical Subway Co.'s conduits, they discovered the old wooden water-pipes of the Manhattan Company,

laid 85 years ago and through which no water had been carried for 50 years or so. These pipes were found about one foot below the cobblestones, and though no water had passed through them for nearly a half century they are remarkably well preserved in most places. They are white pine logs 13 to 15 inches in diameter, with a 4-inch bore through the centre, with hub and spigot ends as shown in sketch. In nearly all cases the rot has penetrated no further than 1½ inches, or through what is commonly called the sap-bands at the outside of the tree. In some places the bore is punky, but not to any considerable extent. The dark shading in the cross-section shows the rotten parts, and is a fair example of the preservation of the timber, the lighter parts being sound.

We know, of course, that timber in water lasts a long time, but in this case there was a subsoil of sand pretty well drained at the bottom, with the soakage of years passing through it occasionally from the surface.

When these pipes were in use the pressure in them presumably never exceeded ten pounds per square inch, and we are informed that the reservoir from which they conveyed the water was in the neighborhood of the Tombs.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
August 27.....	23.55	20.30	22.91	29.75	28.80	23.46	29.82

E. G. LOVE, Ph.D., Gas Examiner.

A CORRESPONDENT of the Manchester (Eng.) *Guardian* gives the following causes which result in large gas-bills, and the remedies for the same:

"1. An escape of gas somewhere on the premises, which, being continued during the whole of the twenty-four hours till stopped, consumes more gas than many extra burners would do of an evening. 2. Incorrect registration of meter against the consumer. 3. Bad and worn-out gas-burners. 4. Increase of gas-pressure in the street-mains, which causes more gas to issue from, or rather be forced through, the orifice of the burner than is required for illumination. The remedy for each of these evils is in the hands of the gas-consumer, could that individual be led to take more than a casual interest in the gas arrangements of his house, shop, warehouse, or factory. The remedies, he says, are: 1. By regular inspection of his premises he can ascertain that there is no leakage, or remedy any defect of that

character. Whether any escape or not exists can be readily proved by turning on the gas at the meter when all the lights are turned off, and then noticing whether the small drum over the index is moving, or any registration of consumption is taking place. 2. By having his own dry meter, which can be examined by a competent and disinterested official for a mere trifle at any time. 3. By replacing gas-burners every twelve or eighteen months. 4. By having a properly constructed self-acting gas-regulator fixed on the supply-pipe from the meter. This will render him altogether independent of the pressure in the street-main, and by having a full supply of gas in his pipes at a uniform pressure he will both increase his illumination, be saved the constant expense and annoyance of breakage of globes, and that troublesome hissing of the gas which is so annoying; and to a certain extent it will purify the atmosphere by permitting the gas to be properly burnt instead of going off unconsumed."

DETLEF LIENAU.

DETLEF LIENAU, who died on Monday at the age of sixty-nine, was for nearly forty years an architect in New York City. He was born in Holstein, Germany; was educated at Stettin and at the technical schools of Munich and Berlin, and finished his architectural studies in France under Labrousse. He came to America in 1848 or 1850, residing in Jersey City, and practicing as an architect in New York. A few months before his death he took up his residence in the latter city.

Correspondence.

A BOOK ON WATER-SUPPLY OF TOWNS.

NEW YORK, August 22, 1887.

SIR: I shall be greatly obliged if you will inform me as to the best books on the subject of supplying towns and cities with water-works, or the best means of getting such information. Yours very respectfully,

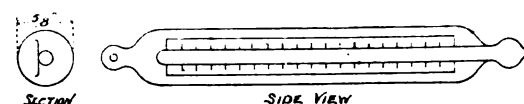
S. W. ROWELL.

[J. T. Fanning's "Water-Supply and Hydraulic Engineering" is the best and, indeed, the only American textbook on water-supply. The chapters on water-supply in Philbrick's "Sanitary Engineering" give a layman a good idea of the problems to be considered, but the technical engineering details are to be found in Fanning's work.]

HOW TO DRESS IN HOT WEATHER.

WASHINGTON, D. C., August 21, 1887.

SIR: Apropos of your 20th August article on "How to Dress in Hot Weather," accept the following notes: Thermometers used, the ordinary thermometers in which the glass mercury tube is protected by a larger tube of glass as an envelope.



Thermometer A has a 5/8-inch naked bright bulb on south window-sill.

Thermometer B has black crape-covered bulb on south window-sill. C, outside north window-jamb in shade. The room is on the ground floor. House faces north and south, with window in north and south walls open and free circulation of air. Height of window-sill above tide, 95 feet.

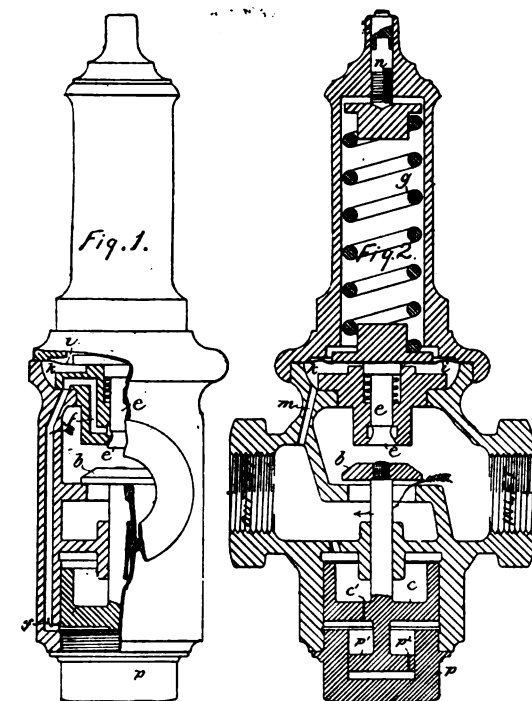
Observations of heat of sunshine—1316 N. Street, W. Washington.

Sunshine thermometer, with bulb covered with black crape, placed flat on a southern wooden window-sill.

1887.	TIME.	SHADE. NORTH.	SUNSHINE. SOUTH SILL.	REMARKS.
July 12	1:15 P. M.	83°	131°	The sunshine thermometer is 95 feet above tide, laid on a wooden sill of a southern window, open to southern airs.
" 13	12:15 "	83°	132°	
" 16	1:20 "	97°	149°	
" 28	12:27 "	.....	141°
Aug. 4	1:17 "	121°	Difference between black crape-covered bulb and naked glass bulb about 10°.
" 9	12:30 "	80½°	146°	
" 10	2:20 "	85°	120°	
" 11	1:40 "	92°	137½°	
" 12	12 M.	80°	141°	11 A. M. to 11:17 A. M. and at 12 M. 147°.
" 13	12:45 P. M.	80°	146½°	
" 19	12:19 P. M.	84°	153°	
" 12	12:30 "	.....	143°
" 12	12:45 "	140°	
" 12	1:20 "	142½°	

These are the temperatures to which men in black hats and women wearing crape are exposed walking between noon and 2 P. M. on the sunny side of a city street without shade. The slightest haze lowers the record. It is highest with a clear blue sky.

M. C. MEIGS.



acts in opposition to the spring *g*, tending to raise the same, and permit the valve *e* to close. When, as in this instance, the regulator is to be used as a reducing-valve, the pressure-chamber *k* is connected by a port *m*, with the outlet portion of the valve-shell, or with any other place containing the fluid, the

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

BOSTON.—Peabody & Stearns have been selected as the architects of the Syndicate Building on State Street. It is to be the largest fire-proof building in Boston. The same architects also have secured the "Fiske Building."

THE Hamilton, Ont., Coffee Tavern Company asks for plans and specifications of a building to be situated on the north-east corner of John and Jackson Streets, Hamilton, Ont., and offer the following prizes for same. For the plans considered best, \$100; for the plans considered second best, \$50. The plans and specifications to be the property of the company. The company does not bind itself to adopt any of the plans; but if any are adopted, the author may expect to be employed to superintend their execution. Plans should be sent, before September 15, to Alfred Powis, Secretary of the Company.

PLANS and estimates for the House of Industry, for the County of Welland, Ont., will be received by the undersigned until September 15. The sum of \$100 will be paid for the plan approved by the County Council. The building is to be located upon the Industrial Farm, one-half mile west of the town of Welland, Ont., and to be constructed of brick, 2½ stories high, exclusive of basement, heated by hot water and to furnish accommodation for sixty inmates. J. C. Page, County Clerk, Welland, Ont.

CAMBRIDGE, MA.S., PUBLIC LIBRARY.—The committee of the Council of Cambridge (of which Mayor Russell is Chairman), having in charge the proposed erection of a new public library building, received, on August 16, competitive plans from McKim, Mead & White, of New York, Peabody & Stearns, Van Brunt & Howe, William E. Chamberlain, and William P. Wentworth, all of Boston. The committee will not consider the plans until the last of September, and before any selection is made the approval of Mr. Frederick Rindge, now a resident of San Francisco (the principal donor of the library), will be required. It was intended to erect the building during the present year, but the committee has decided to postpone action until the spring of 1898.

PLANS and specifications are asked in competition from architects for a large hotel at Redondo Beach, near Los Angeles, Cal. It is to contain 400 rooms and to cost not less than \$100,000. The first premium is \$1,000. Plans should be sent in before September 20. Address Silent, Vail & McFarland, the Redondo Beach Company, First and Main Streets, Los Angeles.

MEETING OF WHOLESALE DEALERS IN PLUMBING AND STEAM SUPPLIES.

The Associated Dealers in Plumbers' Steam and Gas-Fitters' Supplies held their monthly meeting at the United States Hotel, this city, September 1. The association is in a prosperous condition and received numerous additions to its membership.

PROPOSALS.

TOO LATE FOR CLASSIFICATION.

REPAIRS TO PUMPING-ENGINES. (5,000,000 gallons capacity) for Toledo, O. Until September 20. Address the Board of Water-Works Trustees, H. C. Collir, Superintendent.

IRON DRAW-BRIDGE for the Americus, Preston, and Lumpkin Railroad, Georgia. Address at once, B. H. Hardaway, Chief Engineer, Americus, Geo.



Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

For works for which proposals are requested see also the "Proposal Column," pages 371-372-385.

WATER. SEWERAGE. ETC.

MINNEAPOLIS, MINN.—The Minneapolis Water-Works Committee have agreed to erect a new pumping-house to accommodate four pumps, and advertise for two high-duty pumps 12,000,000 gallons capacity each, and 36-inch pipe sufficient to carry water a distance of 2½ miles.

PITTSFIELD, ILL.—Our correspondent writes: "An ordinance has been passed authorizing the expenditure of \$20,000 for water-works. Bids are advertised for to build a tower which will be 101 feet from foot of the foundation to top of the tank. Water will be raised to the tank by steam-pump. Bids are also asked for to lay the mains in front of all store buildings."

LE MAR, IOWA.—Our correspondent writes: "We have made no specific arrangements for water-works so far, but contemplate the erection of a system the coming year, if a satisfactory arrangement can be made."

FORT SCOTT, KAN. wants bids for constructing sewers.

CONCORD, N. H.—The extension of the water service for Penacook will begin in a few days.

NUNDA, N. Y., will have water-works. There will be a reservoir and pumps. The works are under contract.

CLARKSVILLE, TENN.—An agitation is started here for a supply of water from wells.

CAPE ELIZABETH, ME.—The report of the Water Committee has been received and acted on in town meeting. A vote will be taken next April on the proposition of the Portland Water Company. A. V. Cole is of committee for the April meeting.

HERKIMER, N. Y.—A village election was held September 1 to decide on water-works. The surveys have been made by E. D. Smalley, of Utica, who estimates the cost at \$48,200. We have not learned the result.

WASICA, MINN.—A supply of water for fire protection will be obtained from an artesian well.

ABERDEEN, DAK.—The Sewerage Committee has employed a civil engineer to prepare plans and estimates for a system of sewerage.

JERSEY CITY, N. J.—Several corporations and firms have proposed to the Bartlett Water Syndicate to furnish them their water by a supply, separate from the city, on the ground of the cost of the latter. No conclusion has been reached.

LYONS, ILL.—Address the Town Engineer with reference to water-pipe, etc., likely to be needed by the rapid growth of the town.

LARAMIE CITY, WYO.—Several parties are trying to make contracts with the city to supply earthen sewer-pipe.

NORTH PLATTE, NEB.—Work has just begun on the water-works for this place.

AUSTIN, ILL., together with Morehead, has it planned to obtain a supply of water from the recently organized Cicero Water, Gas, and Electric-Light Company.

OGDENBURG, N. Y.—Our correspondent writes: "Water-works were established in this city in 1868, and have been in successful operation ever since. The matter of improving the water by the introduction of the 'Hyatt Filter' has been under consideration, but has been indefinitely postponed by an adverse vote."

OAK PARK, ILL.—Incorporated is the Cicero Water, Gas, and Electric-Light Company to build water-works; Edwin S. Conway, P. W. Herrick, William M. Luff, incorporators.

DAVID CITY, NEB.—A city election, August 20, went in favor of raising \$22,000 for water-works. Work will be begun at once. The City Clerk will give information.

GIRARD, KAN.—Our correspondent writes: "Water franchise granted, but construction doubtful. No progress made."

JEFFERSONVILLE, IND.—The city has contracted with S. R. Bullock & Co. to build water-works, including necessary pumping-engines, a stand-pipe 150 feet high, and to lay about ten miles of pipe; the water to be taken from the Ohio River.

GREENVILLE, MICH.—Our correspondent writes: "I would say there will be a special election held on the fifth day of September to see if the people will bond the city for \$24,000 for water-works."

LAFRER, MICH.—Our correspondent writes: "The Common Council has submitted the question to the voters, whether to issue \$40,000 bonds to construct water-works; election ordered for September 12. It is believed authority will be given to construct the works."

MILWAUKEE.—There is \$48,000 available that the Council has appropriated for the new flushing-tunnel, to be cut through Dane Place, to pump the cold water of the lake into the river.

Fire apparatus and hose will be purchased for the Wauwatosa County buildings by the Committee. Chief Foley, of the Milwaukee Fire Department, acts with the Committee.

DAVID CITY, NEB.—Our correspondent writes: "A. A. Richardson, Consulting Engineer, Lincoln, Neb., will receive bids, until September 22, for constructing water-works at David City. Estimated cost, \$22,000."

DUBUQUE, IOWA.—A strong agitation for better sewerage is under way. City Engineer Tschirgi has prepared plans calling for \$128,000 to complete the system. Aldermen Byrne, Hayden, Trexler, Parker, and Doerfer are a special committee on the matter.

BUFFALO, N. Y.—The Board of Health urges the construction of sewers costing \$300,000.

HAMILTON, ONT.—A new 6-inch iron main and hydrants will be laid on Leeming Street.

BROCKTON, MASS.—With reference to sewerage, the special committee recommends the passage of the following order:

"Ordered, That the Committee on Department of City Engineer duly authorized by order of the City Council, approved August 16 last, to employ a civil engineer to make a survey of the city for the purpose of establishing a system of grades, etc., be and they are hereby further authorized and directed, in connection with said work, to cause to be made contour maps which shall exhibit the drainage area of North Main Street, Centre Street, and of the Packard Swamp section; the total sum expended for work named in this and the order before named, not, however, to exceed the sum named in said order."

ST. PAUL.—The Board of Public Works favors a sewer on Mackubin Street, from Canal to Ronds. Bids are to be advertised for a sewer on Earl Street, from Beech to Mound.

LAKE, ILL.—Our correspondent writes: "Nothing definite has been done in regard to the question of water-works for this town, but we hope to come to some conclusion before long, as the question is a very important one and we must settle it soon."

DEFIANCE, O.—Our correspondent writes: "Our city passed an ordinance August 17 granting a franchise to S. R. Bullock & Co., of New York, for water-works; time to accept franchise, 20 days from passage."

LAMAR, MO.—Our correspondent writes: "The city Board has entered into a contract for water-works, and the contract has been ratified by a vote of the qualified voters of the city. But I have my doubts if the company will erect water-works under said franchise."

BRISTOL, TENN.—Our correspondent writes: "The Board of Mayor and Aldermen of Bristol, Tenn., some two months ago appointed a committee to examine some plans offered said board and report back to said board. But the committee not being satisfied with any plans offered, have not yet reported, and I hardly think any thing will be done this season for water, but cannot say positively as to that."

WHITEWATER, WIS.—Our correspondent writes: "As yet there has been no official action by the Council in the matter of water-works, but the subject has been quite generally agitated among our citizens, and probably the Council will do something with it in the course of the next few weeks. When a system is put in it will not be owned by the city, but by the contractors, and operated on the annual rental plan. Any communications from contractors will now be in order."

Our correspondent encloses a copy of the Mayor's message, from which we quote:

"If we could get sufficient flow of water from an artesian well it would be the most desirable. I would recommend that the council appoint a committee to thoroughly investigate this water-works question and ascertain whether the citizens want water-works or not, and if so, to determine where we shall get the supply, the number of miles of mains required, and the system and plan of operation, etc. You could then make plans and specifications for what the city would need, authorize the receiving of bids for the same, and make a contract with the lowest responsible bidder.—Ed. Engebretson, Mayor."

JERSEY CITY, N. J.—Several new sewers are proposed. Address Alderman Hickey.

ALBANY, N. Y.—The matter of a pumping-engine is under consideration by the Water Commissioners.

POTTSTOWN, PA.—The Pottstown Gas and Water Company has decided to increase its bonded indebtedness \$44,000, to enable it to put down new water-mains and other improvements.

ST. LOUIS, MO.—The Mayor recommends enlargement of the water-works. A bill has been prepared for the matter.

FAIRBURY, NEB.—A. S. Strang has the contract for water-works, 5 miles of mains and 63 hydrants; annual cost to the city, \$3,000.

SAN FRANCISCO, CAL.—An 18-inch sewer is projected for Page Street.

BEACHMONT, MASS.—We last week noticed the movement for sewers. G. W. McLaughlin, H. T. Quinn, and T. S. Coffin are a committee to examine and report.

NEW HAVEN, CONN.—It is proposed that a new section of the Boulevard sewer be built. The work will probably be undertaken at once.

SCRANTON, PA.—Incorporated is the Valley Water Company; John Jermyn, E. E. Hicks, C. Jadione, and others.

SPRINGFIELD, ILL.—Considerable sewer-work is recommended by P. Haggerty, Inspector.

AUBURN, CAL.—Address F. Birdsall about water-works here.

COLUMBIA, MO., wants water-works, and has advertised for proposals.

AUGUSTA, GEO.—The Farmington Water Company will build works here.

PENNSYLVANIA WATER INCORPORATIONS.—The North Huntingdon Water Co.; the Penn Township Water Co.; the Fairfield Water Co.; the Bolivar Water Co.; and the Penn Borough Water Co., of Derry, E. Pitts, Murray Forbes, and J. K. Russell, Derry; C. S. Sims, Mt. Holly, N. J.; and J. C. Sims, Jr., Philadelphia, incorporators.

SANTA ANNA, CAL., has voted to raise \$50,000 for a system of sewers. Contractors should heed this.

WARE, MASS.—The agitation for sewers is active. Contractors and others should address the Road Commissioners.

TEMPLETON, CAL., has taken steps to obtain a supply of water.

WATER COMPANY.—Incorporated is the Los Guilicos, Cal., Water, Light, and Improvement Company; capital stock, \$250,000, divided into \$5,000 shares; directors, J. M. Donahue, N. W. Griswold, A. S. Rhorer, W. H. J. Matthews, and Henry N. Bird.

GLEN ELDER, KAN., is discussing water-works.

YORKVILLE, S. C.—The water-works question is being considered. Address G. N. O'Leary.

WEATHERFORD, TEX.—The city desires correspondence from water-works builders to erect water-works. A liberal franchise will be granted. Address M. E. Cameron.

SUMTER, S. C.—The contract to build water-works has been awarded to Jeter & Boardman, of Brunswick, Geo.

MORGAN, TEX.—Our correspondent writes in regard to water-works to be built by the Morgan Water-Works and Ice Co.: "We begin next week to bore for artesian well, from which source we will get a supply of water. After getting water, we propose to build a large reservoir and stand-pipe to hold the water, from which we expect to run water-mains through the principal streets, thus supplying water wherever needed. E. Winston is Secretary."

PONEROY, O.—Col. E. R. Davenport, of Charleston, W. Va., has been voted a franchise for building water-works. There will be 5½ miles of mains and 60 hydrants; rental, \$2,500 per annum.

GREENSBORO, N. C.—Surveys for water-works are made by E. W. Bowditch, C. E., of Boston, Mass.

MURRAY BAY, ONT.—A company has been formed to build water-works.

EAST TAWAS, MICH.—The Village Council desires proposals, until September 5, for constructing water-works, including about 37,000 feet of water-pipe, 4-inch to 14-inch, 23,000 pounds of castings, and pumping-engines with boilers, capacity at least 500,000 gallons daily. Will Mowray is Village Clerk.

LOS ANGELES, CAL.—The Lankershim Ranch Company has been organized to erect buildings, develop the needed water-supplies, and conduct a large ranch about ten miles from Los Angeles. J. B. Lankershim, L. T. Garney, C. W. Smith, and R. W. Poindexter are interested.

AUSTIN, MINN.—The contract for the Austin Water-Works has been let to the National Iron and Brass Works, of Dubuque. The price is \$36,000.

GAS. STEAM. BUILDINGS. ETC.

SALT LAKE CITY.—The contract for the construction of the U. S. Penitentiary has been awarded to the Pauly Jail Building and Manufacturing Co. of St. Louis, at \$48,000.

ST. PAUL, MINN.—Incorporated is the Brainerd Electric-Light Company; capital stock, \$100,000. Incorporators, John C. Rosser, William E. Seelye, Oliver H. Havill, all of Brainerd.

The Stillwater Gas-Light Company changed the name of incorporation to the Stillwater Gas and Electric Light Company, with a capital stock of \$60,000.

LOUISVILLE, KY.—The Union Gas Company has struck a great flow of gas on the fields 25 miles from the city. It is proposed to pipe the gas from Louisville.

PITTSBURG, PA.—Manufacturers of oil-main iron pipe should address the Western and Atlantic Pipe Lines, which will pipe oil from the Washington fields.

BOSTON.—A charter has been granted to the Union Gas-Light Company of Rockland. Jerome B. Poole, President; Albert Culver, Treasurer; capital stock, \$15,000, in 150 shares.

TOLEDO, O.—The Toledo Natural-Gas and Oil Development Company will develop its fields. Address Secretary R. D. Whittlesey.

LAKE, ILL.—The Economic Light and Heat Company asks for a franchise to lay gas-mains and furnish gas at \$7.25 per 1,000 cubic feet.

READING, PA.—Address William M. Kaufman, President of the Reading Steam, Heat, and Power Company, about furnishing the necessary plant. Addressed to the Board of Trade Rooms, 532 Penn Street, will reach him.

JANESVILLE, WIS.—Proposals for steam-heating apparatus in the Second Ward School building will be invited by the Board of Education.

SAN FRANCISCO, CAL.—The California Wharf and Warehouse Company filed articles of incorporation recently. The capital stock is \$250,000. The Directors are Robert Balfour, Robert Bruce, Park Fellows, Charles Page, and Charles P. Eells. The objects are to acquire land and buildings for the storage of grain and other articles of commerce.

ILLINOIS INCORPORATION.—Incorporated is the Sparta respecting Company at Sparta, capital stock \$3,000, to prospect for gas, oil, salt, and other materials; incorporators, W. R. Borders, S. W. McGuire, W. J. Lyle, and others.

ASHLAND, WIS.—The County Commissioners will receive bids for a \$20,000 jail.

WINONA, MINN.—The County Commissioners have ordered advertising for bids for the construction of a new court-house. Architect Maybury will prepare plans. The cost will be \$100,000.

ST. PAUL, MINN.—The Minnesota Natural-Gas, Oil and Fuel Company. Capital stock, \$1,000,000. Incorporators: William P. Sergeant, Robert M. Todd, Edward S. Prentice, Thovold V. Knatvold John P. Hovland, Charles C. Dwight, William McAdam, James H. Parker, D. F. Morgan, all of Albert Lea, where the place of business is to be located.

YAZOO CITY, MISS.—The city intends to bore one or more artesian wells.

RESACA, GEO.—A bill to incorporate the Resaca Canal and Manufacturing Co., of this place, with a capital stock of \$50,000, is now before the General Assembly. The firm contemplates to cut the canal, erect buildings for manufacturing purposes, and operate various kinds of industries.

KNOXVILLE, TENN.—The Knoxville Natural Gas Company will sink a large well. The American Well Drilling Company, of Louisville, R. Carroll, President, has the contract.

TOPEKA, KAN.—Organized is the Natural Gas and Mineral Exploring Co.; D. T. Paine, President; M. S. Evans, Secretary.

SAN FRANCISCO, CAL.—Incorporated is the California Cold Storage Company; capital stock, \$1,000,000, divided into 5,000 shares; directors: W. R. Smedberg, James O. Cashin, L. J. Harrison, Reed Jones, and D. M. Cashin. The company is formed to store and preserve fruits and vegetables.

BOSTON.—The Superintendent of the Lamp Department of Boston received proposals Thursday, September 1, for furnishing gas for a term of three years in the suburban districts, known as West Roxbury, Jamaica Plain, Brighton, Dorchester, South Boston, East Boston, and Charlestown. Each lamp is required to burn 3,228 hours in each year. The bids were as follows: East Boston Gas Co., \$1.65 per 1,000 feet; South Boston Gas Co., \$1.65; Dorchester Gas-Light Co., \$2; Jamaica Plain Gas Co., \$2; Charlestown Gas Co., \$1.65; Roxbury Gas Co. for burners of more than fifteen feet per hour, \$1.30; all others, \$1.65; Brookline Gas Co., large burners, \$1.85; all others, \$2. The contract was taken under advisement.

FORT SMITH, ARK.—The Fort Smith Natural-Gas and Power Company, capital \$50,000, will sink gaswells. H. E. Kelly is President, J. H. Cornell, Vice-President.

ERIE, PA.—The Presque Isle Natural Gas Company has closed a contract with the Buffalo Oil Company, of Lima, O., to bore a deep well. The cost will not exceed \$12,000.

BRIDGES.

MINNEAPOLIS, MINN.—Bids are asked for on the Marshall Avenue and Lake Street bridge. J. S. Senoll, of St. Paul, is the Engineer; S. A. Condit is Secretary of the Bridge Commission.

BOSTON.—The contract for the masonry and piers for the Harvard Street Bridge has been awarded to Messrs. Shields & Carroll.

BOSTON.—The building of a new caisson for the dry-dock at the Charlestown Navy Yard, for which \$31,000 was appropriated by Congress, has been abandoned. The lowest bid received was from the Atlantic Works, and the figures were about \$4,000 more than the appropriation. It has been decided to reconstruct the old caisson, using the frame, and for this purpose it has been towed into the dry-dock. To refit, the expense will be a matter of \$10,000 or more.

MONTGOMERY, ALA.—The South and North Railroad Company will build an iron bridge over the Alabama River, to be finished January 1. Construction is begun.

THE Missouri River Bridge and Iron Co. have been awarded the contract to build a bridge at Denver. Cost \$25,850.

WILMINGTON, VT.—The Vermont Construction Co., of St. Albans have been awarded the contract to build an iron bridge over the Winooski River.

CHATTANOOGA, TENN.—The Chattanooga Bridge Company has signed a contract with the Decatur, Ala., Bridge and Contracting Company, by which the latter agrees to construct a bridge for \$108,000.

SAN FRANCISCO, CAL.—A railroad bridge will soon be undertaken over Carquinez Strait, near Vallejo Junction.

CINCINNATI, O.—On September 10 bids will be received by the Commissioners of Hamilton County for constructing an iron bridge on Dick Road in Crosby Township; also a bridge in Sycamore Township. Address Fred Raine, County Auditor.

CINCINNATI, O.—The County Commissioners propose to erect a bridge on the road from Montgomery to Hinghaus.

PEORIA, ILL. (Special).—A special election was held August 30, for the purpose of obtaining the sentiment in regard to the construction of a new free bridge across the Illinois River. About half an average vote was polled, and it was practically unanimous for the bridge. The structure will cost about \$50,000.

ALBANY, N. Y.—Proposals will be received by the Superintendent of Public Works until Tuesday, September 13, at 12 o'clock, noon, for building iron bridges, abutments and approaches over the Erie Canal, at Hudson and Austin Streets, in the city of Buffalo. James Shanahan, Superintendent Public Works.

OREGON CITY, ORE.—Plans for a suspension bridge over the Willamette River have been prepared. The span will be 475 feet.

STREET WORK AND PAVING.

MINNEAPOLIS, MINN.—The improvement of Franklin Avenue, from Thirteenth Avenue to the river, has been decided on by the Street Commission.

MINNEAPOLIS, MINN.—T. M. Bohan, Philip Beck, John McGowan, and H. E. Blaisdell are on a committee to look up a site for a new park.

CINCINNATI, O.—The Board of Public Affairs is asking bids on paving and other work for Crawfish Creek Road.

BOND HILL, O.—E. F. Layman, C. E., of Cincinnati, has made plans for grading, macadamizing, etc., for certain streets.

MT. AIRY, O.—Plans for street-works, with drains, etc., have been prepared by A. A. Brasher, of Cincinnati, engineer.

JERSEY CITY, N. J.—Considerable street-work will be done, including improvement of Manhattan Avenue from Central to Sherman Avenue; sewerage Webster Avenue and Hancock Avenue.

OAKLAND, CAL.—Street-work, including sewerage with vitrified pipe, will be done on Tenth Avenue. Address J. W. Tompkins, Superintendent of Streets. Similar work will be done on Hannah Street.

FOND DU LAC, WIS.—The contract for paving Main and Forest Streets has been given to L. Schoenland, the lowest bidder, at \$1.13½ per square yard.

FORT WAYNE, IND.—Joseph Derheimer has received the contract for paving Calhoun Street with cedar blocks at 98 cents per square yard.

TORONTO, ONT.—has under consideration a by-law appropriating \$400,000 to harbor improvements, etc.

SYRACUSE, N. Y.—The City Engineer will advertise for proposals for paving and gutter-work, and for paving material and pipe-sewer.

SAN DIEGO, CAL.—Address Bernard King, Superintendent of Streets, about improvements on C Street and others.

ALLEGHENY, PA.—Charles Ehlers, City Engineer, can give information about the proposed improvements of Strawberry, Gane and Ashton Streets.

TRFNTON, N. J.—Grading, etc., on Lawlerton Avenue. C. C. Haven, City Surveyor, will give information.

CINCINNATI.—Bids are asked for by the County Auditor for improving the county road from corporation line to the village of Reading.

TOPEKA, KAN.—The City Engineer will make plans and specifications for the approaches of the Sixth Avenue viaduct.

CINCINNATI, O.—The Board of Affairs wants proposals for grading, flagging, etc., of Fern Street. Thomas G. Smith is President.

SAN DIEGO, CAL.—It is settled that the paving and sewerage of Fifth and Sixth Streets will soon be undertaken. John G. Capron, contractor, has already offered to do the work under bonds for \$100,000.

TOLEDO, O.—Bids are wanted until September 12 for macadamizing Infirmary Road. Address Charles A. Vordtriede, County Auditor, Toledo.

MINNEAPOLIS, MINN.—Contracts for street work have been awarded by the Public Works as follows: Grading Goodrich Avenue, for \$5,150, to James Keating; grading Summit Avenue, for \$11,845, to Murnane & Keough; grading Hamline Avenue, for \$3,104, to Murnane & Keough; grading Milwaukee Avenue, for \$7,000, to Kuhr & Bahr; sewer on Fillmore Avenue, for \$1,850, to McArthur Bros. The assessments for slopes on Maud Street and grading Dearborn Street were adjourned. The assessment for condemning and taking an easement for a sewer along the right of way of the St. Paul and Duluth Railroad Company was completed, and the clerk directed to give confirmation notice, and the assessment for widening Cliff Street was corrected and confirmed. Correction was ordered on the assessment for paving Wabasha Street.

TOPEKA, KAN.—Address the City Engineer about paving on Quincy and Jackson Streets, North Topeka.

RAILROADS, CANALS, ETC.

CHILLICOTHE, ILL.—Incorporated is the Chillicothe Street Railway Company. Lewis S. Hoyt, W. M. Mead, J. P. Laurie, and others.

ST. PAUL, MINN.—The North Dakota and Pacific Railway Company has been incorporated to build a railway from some point in Norman County to a point in Dakota, the route to be selected by the directors. Principal place of business, St. Paul. Capital stock, \$2,000,000. Incorporators: Charles G. Lawrence, Harris Richardson, Louis E. White, Joseph T. Avery, Walter J. Trask, all of St. Paul.

ST. PAUL, MINN.—Incorporated is the Duluth Terminal Railway Company, to operate a line or lines of railway along the shores of Superior Bay and St. Louis Bay in St. Louis County. Capital stock, \$2,000,000. Incorporators: G. G. Hartley, Alonzo J. Whiteman, William W. Billson, William F. Phelps, R. S. Munger, Josiah D. Ensign, Charles E. Shannon, M. R. Baldwin, J. H. Triggs, Luther Mendenhall, Asa Dailey, C. H. Graves, Alex. McDougall, Jacob R. Myers.

MOBILE, ALA.—Incorporated is the Mobile, Hatesburg, and Jackson Railroad Company. Capital \$300,000. A. Austill and others are incorporators.

MORRISVILLE, N. Y.—On August 20 the Canastota, Morrisville, and Southern Railroad Company was organized. Work will begin this fall.

SAN MARCOS, TEX.—A new line of railroad is being surveyed from San Marcos to the Pandale Railroad.

CANAL.—Superintendent of Public Works Shanahan opened bids August 21 for the enlarging of locks 8 and 48 on the Black River Canal, and has awarded the contracts as follows: Lock 8 to Thomas H. Stryker, Rome, for \$10,508.50; lock 48 to James E. Flood & Co., Sandy Hill, for \$9,895.50.

MILWAUKEE.—Twelve surveyors of the Wisconsin Central line are at work on the proposed railroad extension from Rib Lake to Tomahawk, Wis.

The Chicago, Milwaukee and St. P. R. R. Co. will build an extension from Geneva Lake and Milton Junction to Libertyville.

The Chicago and N. W. R. R. Co. will extend their tracks from Lake Geneva to Fontana and on Harvard Junction.

NEW YORK CITY.—The Dock Department has plans ready for docks from One Hundred and Fifty-Ninth Street to High Bridge. Other piers also are to be built.

PEORIA, ILL.—On October 11 a meeting will be held to consider the connecting of Lake Michigan with the Mississippi River by canal.

BLOCK ISLAND, R. I.—The Town Council of Block Island has contracted with S. V. R. Hendricks, of Easthampton, Mass., to open the Great Salt Pond on the west side of the island to the sea by a channel twenty-five feet wide and four feet deep at mean low water. Piles are to be driven on either side of the channel for 300 feet and on one side there is to be 500 tons of rip-rap stone leading out into the ocean to protect the channel from drifting sands. The channel will have a depth of seven feet and one inch at high water. The town appropriated for the work \$10,000, \$8,550 of which is given to the contractor, the work to be begun on or before the 30th of September and is expected to be completed on the first of January.

ROCHESTER, N. Y.—The Rochester Cable Railroad will build a line, involving much work of track-laying, etc.

LOS ANGELES, CAL.—An electric street railroad is projected by J. H. Brook, Hervey Ludley, and C. E. Day. The Julian motor will be used.

SAN DIEGO, CAL.—A street-car line will be built by George H. Crittenden and Frank I. Johnson.

CHATTANOOGA, TENN.—The Chattanooga Southern Railroad Company proposes to build from Chattanooga to the Tennessee line. Capital, \$1,000,000.

NEW ORLEANS, LA.—The only bidder for constructing the first section of the Diamond Island Bend Levee (200,000 cubic yards of earth-work), was Peter Trezant, at 25 cents per cubic yard. The Board of State Engineers recommended that the contract be awarded to him.

DULUTH, Red Wing and Southern Railway Company will be built to River Falls at once.

SISKIYOU, CAL., will vote on raising \$85,000 for six miles of railroad.

ISHPEMING, MICH.—The contract for the extension of the Chicago and Northwestern Railroad from Ishpeming to Republic, Mich., with a branch to Michigamme, was let, August 25, to Langdon & Co., of Minneapolis, railroad contractors. The survey is nearly completed, and a very large force of men will be put at work immediately. Langdon & Co. will complete the line of the Minneapolis, Sault Ste. Marie and Atlantic Railroad from Minneapolis to Manistique, Mich., this season.

LOUISVILLE, KY.—J. R. Serpell & Co. have received contract, and will build ten miles of very heavy work on Lynchburg and Durham Railroad.

WATERWAYS.—A convention of those interested in Western waterways will be held in Memphis, Tenn., October 20 and 21.

CLEVELAND, O.—It is proposed to consolidate the existing street-car lines and then build extensive additions, constituting a belt line. Address George Multern, of the Woodland Avenue and West Side Railway.

PHILADELPHIA.—The contract for grading the extension of the Reading Railroad from Glassboro to Mullica Hill has been awarded to Frank Thomas, of Shippensburg, Pa., and work is to be commenced immediately. The road will cost \$85,000.

BETHLEHEM, PA.—The Lehigh and Lackawanna Railroad will be extended from Wind Gap to Stroudsburg, in Monroe County. The contract for the first section of five miles, from Wind Gap to Saylorsburg, has been let, and work will begin on Monday.

EASTON, PA.—The Electrical Railway Company has given the contract for the line to College Hill to the Datt Company. Work will be begun at once.

MILWAUKEE.—The Chicago and N. W. R. R. Co. have let the contract to build forty-four miles of railroad in Michigan from Metropolitan to Republic to Langland & Co. of St. Paul.

The Cream City Railroad Co. will extend its track on North Water, Brady, and Racine Streets. Steel rails have been ordered.

The opposition to the cable roads here is dying out, and West Siders are anxious now to have them built and have notified the City Clerk to that effect.

GOVERNMENT WORK.

MANCHESTER, N. H.—Synopsis of bids for labor and material required to complete the building ready for interior finish for post-office, Court-House, etc., opened August 22, by the Supervising Architect:

Oliver S. Giddings, \$138,950, Concord granite; course; No. 8 cut.

Head & Dowst, \$127,785, granite, Sargeant & Sullivan, Concord, N. H.; course; as per specification.

Creedy & Noyes, \$127,705, granite, Railway Bay Concord; course; as per specification.

Mead & Mason & Co., \$110,578, granite, Concord; course; No. 8 cut.

Clinton G. Smith, \$124,448, marble, Sutherland Falls; as wanted; as wanted.

Clinton G. Smith, \$120,448, granite, Concord; as wanted; as wanted.

Sargeant & Sullivan, \$131,000, granite, Concord; course; as per specification.

MANCHESTER, N. H.—All bids for constructing the Government Building here have been rejected by the Supervising Architect of the Treasury, as being too high. The specifications have been changed, now calling for brick with stone trimmings in place of granite, and new proposals are asked for.

BOSTON, MASS.—The following bids for removing Babson's Ledge, Gloucester Harbor, to 14 feet at low water, were received by Col. G. L. Gillespie, August 30:

W. D. Duncan & Nickerson, 105 Atlantic Avenue, Boston, Mass., \$14.75 per cubic yard.

Thomas Symonds, Leominster, Mass., \$21 per cubic yard.

Charles H. Edwards, 35 Hawley Street, Boston, Mass., \$59 per cubic yard.

SYRACUSE, N. Y.—Synopsis of bids for steam-heating and ventilating apparatus for court-house, etc., opened August 25, by Supervising Architect:

Pierce, Butler & Pierce Mfg. Co., \$21,500, Reed's; fan, as specified.

S. I. Pope & Co., \$17,190, Crane; fan, 54 inches as shown, No. 188.

E. P. Bates, \$18,500, Reed's; fan, Blakeman, 7 feet 6 inches diameter.

West Point Engine and Machine Co., \$13,089.24, Bundy direct; fan, Buffalo blower.

Hartlett, Haywood & Co., \$16,306, vent-tube, own; fan, Exeter or Sturtevant.

Edward Joy, \$19,990, Walworth; fan, 72-inch Blackman.

SYRACUSE, N. Y.—The contract for steam-heating apparatus in the Government Building here has been awarded to the West Point Engine and Machinery Co., of West Point, Pa., at \$13,089.24.

POST-OFFICE, etc., Concord, N. H.—Synopsis of bids for joining, plastering, etc., opened August 27, by the Supervising Architect:

L. D. Willcutt, \$32,452; additional flooring, 15c. per square foot.

Mead, Mason & Co., \$27,200; 10c. per square foot.

John Moore, \$24,150; 12c. per square foot.

SYNOPSIS of bids for iron-fence work, Marine Hospital, Baltimore, Md., opened August 29 by the Supervising Architect of the Treasury: Joseph Norwood, \$2,085; Chester B. Albree, \$1,070; Van Dorn Iron Works, \$1,888; Champion Iron-Fence Co., \$754.82; J. E. Bolles & Co., \$821.82; George H. Pagels & Sons, \$1,225.

SYNOPSIS of bids for stairs at Peoria, Ill., opened August 24, by Supervising Architect: Poulson & Eger, \$6,550; Champion Iron-Fence Co., \$4,475; The Winslow Bros. Co., \$4,350.

BOSTON, MASS.—Colonel Gillespie has submitted during the past fiscal year the following estimates for necessary work during the coming fiscal year: Extension of sea-wall, George's island, \$10,000; extension of sea-wall, Galloupe's island, \$7,500; extension of sea-wall, Long Island, \$3,000; work on sea-walls, south end, east bluff, Governors island, \$80,000; widening main ship channel at upper middle, \$250,000; completing Fort Point channel, \$60,000; widening and deepening Nix's mate channel, \$25,000; total, \$435,000.

BIDS OPENED.

MARQUETTE, MICH.—The following bids for heating and ventilating apparatus for the State Prison were received by E. P. Rogers, President Board of Commissioners, August 24: Kruse & Barker, Milwaukee, Wis., \$11,790; Kelly & Jones Co., Pittsburg, Pa., \$12,907; Detroit Metal and Heating Works, Detroit, Mich., \$12,000; Samuel I. Pope & Co., Chicago, Ill., \$10,970.

BLOCK ISLAND, R. I.—The following bids for opening a channel between Great Salt Pond and the ocean were received by Joseph P. Cotton, C. E., of Newport, August 27: Hartford Dredging Co., Hartford, Conn., \$16,060; Frank Pidgeon Dredging Co., New York City, \$9,600; Charles H. Edwards, Boston, Mass., \$9,294; John Van Patten, Albany, N. Y., \$9,250; S. V. R. Hendrix, Easthampton, Mass., \$8,450.

MARQUETTE, MICH.—At a meeting of the Upper Peninsula Prison Board, August 26, the following contracts were let: Cell block, \$24,400; boiler stock, \$3,000; conduit, \$1,200, to Wahlmann & Grip, of Ishpeming. The water system was let to R. R. French, of Marquette, for \$7,100. Steam-heating and ventilation were let to Samuel I. Pope & Co., of Chicago, for \$10,970.

PHILADELPHIA.—Bids were opened by the Director of Public Works, August 20, for the continuation of the Manayunk Intersecting Sewer along Canal Street, 2,315 feet N. W. from Levering Street. The first section consisted of a brick sewer 2'10"x3'7", and the second of cast-iron pipe 2'9"x3'6". Bids for flushing-chamber, some 12-inch terra-cotta pipe were also received. The bids were as follows: R. A. Malone & Sons, at \$13.87 per linear foot for the brick sewer, \$25 per linear foot for the iron pipe, \$2,500 for the flushing-chamber, and \$2.56 per linear foot for the terra-cotta pipe; James Deehan bid \$13 for the brick, and \$13.08 for the iron sections, \$5,000 for the flushing-chamber, and \$3 per foot for the terra-cotta pipe; James Sullivan bid \$13 for the brick and \$15.80 for the iron, \$2,500 for the flushing-chamber, and \$3 per foot for the terra-cotta pipe; James F. Kennedy bid \$13.23 for brick and \$14.20 for iron sections, \$2,200 for flushing-chamber and \$3.50 per foot for pipe. The total cost of the section will be about \$32,000.

There were also bids opened for the construction of thirty-five small branch sewers, the principal one being two sections of a sewer on Girard Avenue. For the first section, 322 feet, 2,800 feet long, from Sixth to Broad Streets, John M. Mack bid \$4 per foot; P. C. & T. McEntee, \$3.25; B. F. Shelmire, \$3.87; James Deehan, \$3.50; H. P. McTague, \$3.29; John Noonan, \$3.09.

For the second section, from Sixth eastward to Frankford Road, a distance of 3,000 feet, the bidders were: John M. Mack, \$4; P. C. & T. McEntee, \$3.72; Shelmire, \$3.73; Deehan, \$3.50, and McTague, \$2.83 per linear foot.

MILWAUKEE.—Bids opened August 26 for repairing pier, North Point Pumping Station: William T. Casgrain will receive \$14 per pile, \$14 per M for 12x12 timbers, \$50 per M for white oak timber, 5½c. per lb. for screws, \$12 a cord for stone, \$15 per 1,000 feet for re-laying old work, 5c. per lb. for straightening old rods and bolts.

Bids opened August 26 for Section No. 5, Menominee Special Intersecting Sewer: J. J. Crilly, \$6,200; J. C. F. Brand, \$6,100; John O'Neil, \$5,937; William Forrester, \$6,200; James Markey, \$6,050. The contract was let to John O'Neil. The job will be very difficult, as a tunnel must be made under the river through marshy land. The work must be completed in six weeks.

BROOKLYN.—Bids were opened by the Department of City Works August 30, for building a station-house and court-house, as follows:

George W. Williams, for work complete, \$73,375; J. R. Schoonover, for work complete, \$68,700; Leahy & Moran, for work complete, \$62,000; P. J. Carlin, for work complete, \$62,000; W. & T. Lamb, Jr., for work complete, \$61,535; Charles Collins, for work complete, \$59,480; H. O'Rourke (bid informal).

AITKIN, MINN.—Bids were opened on construction of court-house as follows: T. P. Hardy, \$14,850; Gregg & Griswold, \$13,670; W. F. Chadbourne, \$13,475; Alexander Grant, \$13,200. Grant was awarded contract.

ST. PAUL.—The contract for wood-work on the new court-house has been awarded to the Bohn Manufacturing Co., of this city, \$78,000.

MILWAUKEE.—Stone curbing on Cedar Street from Ninth to Fifteenth Street: H. Vogt, at 55c. per linear foot. C. A. Beck & Co. were awarded the contract for furnishing 2,000 yards of cedar block for repaving streets in Fifteenth Ward at 55c. per square yard.

For paving Third Street with stone from Chestnut to Vliet Street: J. M. Cannon, \$2.84 per square yard; J. Clauser, curbing same street, 54c. per linear foot; stone curbing on Jackson Street from Ogden to Pleasant Street, 54½c. per foot, Fred Andres, Contractor.

PHILADELPHIA.—Bids were opened August 25 by the Survey Committee of Councils for the construction of thirty-five branch sewers. The following bids were also received for the construction of the Manayunk intercepting sewer from Levering Street northward a distance of 2,315 feet: R. A. Malone & Sons, \$34,603.80; James Deehan, \$35,168.50; James Sullivan, \$32,605, and James F. Kennedy, \$32,000.20. The contracts will be awarded after Director Wagner shall have examined the proposals.

JERSEY CITY, N. J.—Bids for furnishing a steam-boiler to the asylum were opened August 23 as follows: Hugh Leslie, \$1,375, will give \$15 per ton for the old boiler; John McLaren, \$1,720, and \$700 for the old boiler.

NEW YORK CITY.—The contract for repairs and alterations in the retreat building on Blackwell's Island has been awarded to James Moore at \$25,700.

CANAL WORK.—Superintendent of Public Works Shanahan has received these bids for rebuilding locks on the Black River Canal in this State: Lock eight, Thomas H. Stryker, of Rome, \$12,168; James E. Flood, of Sandy Hill, \$12,532. Awarded to Stryker. No. 48, Thomas H. Stryker, \$11,508; James E. Flood, \$9,805; Philip McGuire, of Forestport, \$12,760. Awarded to Flood.

MILWAUKEE.—The Schlitz Brewing Company have awarded the contract for furnishing the iron columns for their new malt-house for \$17,500 to William Bayley & Co.

J. C. F. Brand will lay 304 feet of pipe-sewer in Sycamore Street for \$547.20; Dan O'Driscoll, 702 feet, Kinnickinnic Avenue, \$1,368.34; John O'Neill, pipe sewer, Second Street, \$2.35 per linear foot; A. C. Murphy, 383 feet of pipe sewer in Garfield Avenue, \$564.19; J. J. Crilly, laying 431 feet of pipe-sewer in Fourteenth Avenue.

BOSTON.—The Boston Water Board received on Wednesday proposals for building iron roofs at the Chestnut Hill pumping station. The G. W. & F. Smith Iron Company bid \$8,675, and the Philadelphia Bridge Works, \$6,750. The contract was awarded to the Philadelphia Bridge Works.

BOSTON, MASS.—The following bids were received by City Engineer of Boston, Mass., for building ferries for the East Boston Ferries: McInnis & Parker (awarded), \$12,995; William A. Norton, \$11,000; J. N. Hayes & Co., \$14,250; William A. Kenrick & Son, \$14,670.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.
NUMBER 15.

PUBLISHED EVERY SATURDAY.

NEW YORK, SEPTEMBER 10, 1887.

LONDON, SEPTEMBER 24, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

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Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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NATIONAL APPROPRIATIONS FOR RESERVOIRS IN COLORADO.

MR. ORANGE JUDD, for many years identified with agricultural journalism, has been visiting Colorado and is reported in the *Denver Republican* to strongly advocate the construction by the United States Government of reservoirs in the mountains of that State for the storage of water to be utilized in irrigating large tracts of land now unavailable for cultivation because of the absence of the water needed for irrigation. Mr. Judd says:

"There is no other way in which the general Government can accomplish so much good for the country as to expend a considerable portion of its surplus millions in investigations and then in establishing a system of reservoirs to conserve the vast quantities of water which run to waste every year and which, if husbanded and let down when needed, would add untold millions to the wealth of the country. At the head-waters of the great 'agricultural rivers'—the Colorado, the Rio Grande, the Arkansas, the two great branches of the Platte, and numerous other streams—a system of dams or embankments could be constructed across the gulches at comparatively small expense which would hold water enough to supply the wants of many millions of acres that would become veritable gardens and fields of the highest productive fertility. By a little co-operation among the citizens of this State, and perhaps of adjacent States and Territories, in the employment of one or more competent men to enlighten the members of Congress, they could be readily induced to make all needful preparations for preliminary investigations, and then for carrying out the idea to practical results. One hundred, or even fifty millions of dollars thus expended, would undoubtedly add thousands of millions of dollars to the productive resources of the country."

If there are no waterways within the State of Colorado on which Government money can be properly spent, it is not strange that the citizens of that State should claim a share of the money annually expended for internal improvements for the building of storage reservoirs to hold water for irrigating tracts of land now valueless, thus adding wealth to that community, just as in other localities it has been added by the improvement of water highways.

The point, however, on which this question must be decided in order to secure United States aid is, "Will the water thus stored be available for use by the citizens of more than one State, and will its disposition be under United States control?" If not, and if only available for one State, we should consider it a waste of time to try and secure aid from the United States Government.

NEW YORK INSANE ASYLUM ABUSES.

THE report of the Commission of the State Board of Charities of New York in the matter of the investigation of the New York Asylum for the Insane seems to be a carefully prepared and sensible document. The Commission find that the buildings have been greatly overcrowded, there being nearly two thousand patients, with proper provision for the care of only one thousand; that there has been undue economy of expenditure for food, and insufficient salaries paid to secure proper nursing and attendance; and that the cooking is bad, "made necessarily so by the inadequate appliances in a kitchen intended for five hundred patients and made to pass through its processes, called cookery, food for over 1,700 patients besides

attendants." As the commission remark, "this condition of things is wrong and shameful; especially does it appear so in view of the fact that the patients compelled to eat the mixtures set before them are not ordinary paupers, but insane persons—that is to say, sick persons, and many of them acute cases, requiring for their recovery, as well as comfort, wholesome, digestible, and nutritious food."

The responsibility for this state of things rests mainly on the Board of Estimate and Apportionment, who have refused to grant the sums necessary to secure proper treatment for the unfortunate wretches whose diseases and necessities have forced them into this asylum. The Commissioners of Charities and Correction are held, in a measure, responsible, because of their neglect to present each year proper estimates, with evidence of their necessity.

The whole system is a bad one, because of the unbalanced estimates, divided responsibility, and want of proper accountability.

The methods of relief recommended by the commission are divided into provisional and permanent, the former including the means which can be applied at once and which will certainly effect great improvement, the latter including changes in the system which will probably require State and possibly national legislation.

The Board of Charities and Correction clearly has a greater field of duty than it can possibly supervise personally, and it does not employ skilled and properly-paid agents to do that part of its work which it cannot do by its own members. The standard of efficiency, which seems to have been the sole thing kept in view, has been cheapness—cheap food, cheap cooking, cheap nurses—and the results are disgraceful to the city of New York, which is abundantly able to take care of its sick and insane poor without starving them or committing them to the charge of drunken, ignorant attendants.

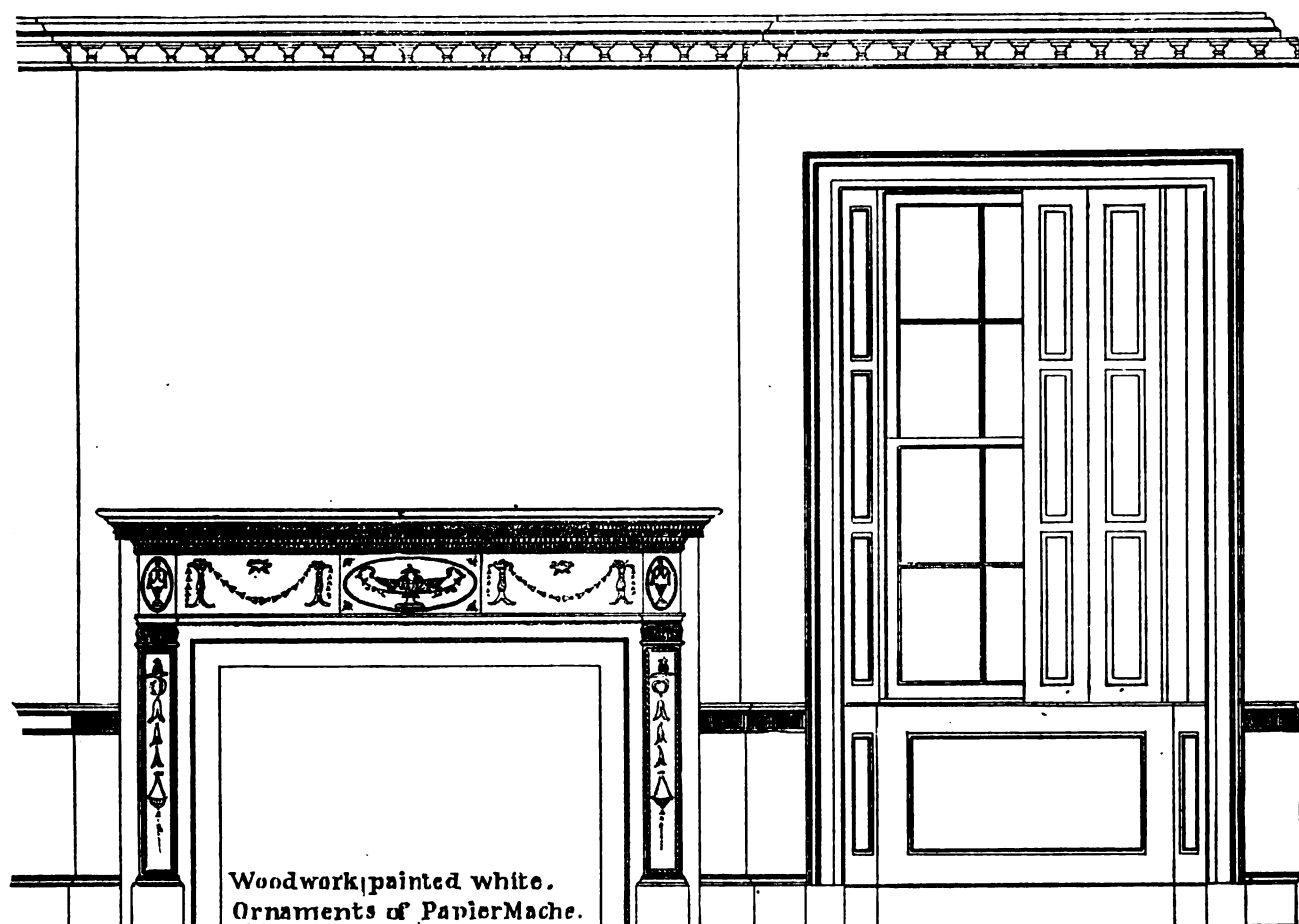
NAVIGATION OF THE GREEN AND BARREN RIVERS IN KENTUCKY.

FROM a report to the Chief of Engineers by a board appointed for the purpose, consisting of Majors W. R. King, Amos Stickney, and A. Mackenzie, all of the U. S. Engineers, we learn as follows: The questions especially given them to answer were: What are the commercial importance and value of the works and property of the Green and Barren River Navigation Company? They were also to furnish estimates of the cost of making commerce free by the purchase of the rights and franchises of the company.

These rivers lie wholly within the State of Kentucky, and drain about 10,000 square miles. Their general direction is north-west, and the Green, after receiving the waters of the Barren River, empties into the Ohio about eight miles above Evansville, Ind.

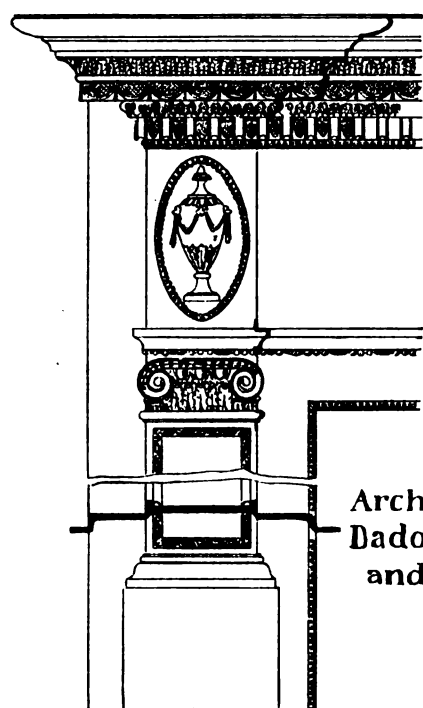
About fifty years ago the State undertook to improve the river by locks and dams. Four locks and dams on the Green and one upon the Barren were completed, and by means of them a continuous navigation for vessels of four-foot draught was obtained to Bowling Green, 175 miles from the Ohio.

The scheme was operated by the State until 1868, when the Navigation Company was chartered and the control transferred to it for thirty years, making it practically owner of the locks and dams.

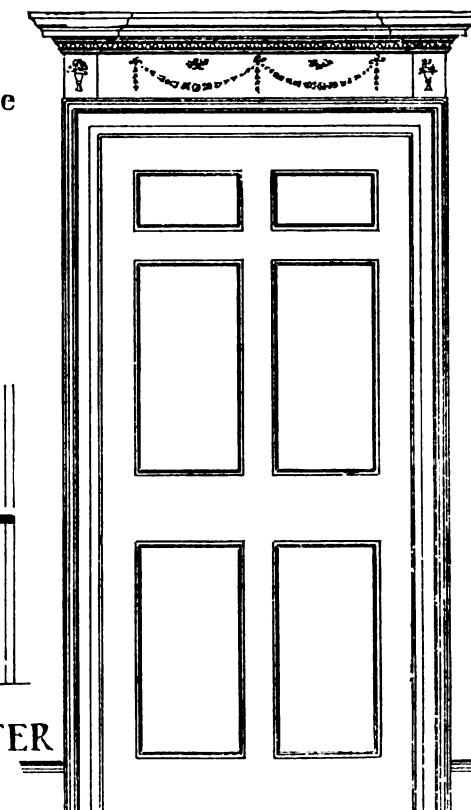
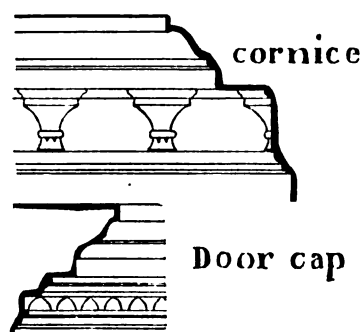


Scale

Scale of Details.



Architrave
Dado cap
and Base



DETAILS FROM HOUSE AT DORCHESTER
MASS. Built about 1800.

Measured and drawn by W. H. Brainerd.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HOUSE IN CAMDEN, N. J.

WILSON EYRE, ARCHITECT.

Green River has some remarkable characteristics. Rising in the central part of the State, it flows with a gradual descent nearly south-west to within 100 miles of its mouth, and then north-west to the Ohio. The country drained is comparatively level, and the river is free from sudden freshets.

For the last 150 miles of its course it has the remarkable depth of twenty to thirty feet, with only occasional obstructions by rocky reefs. This great depth is the probable cause of its freedom from ice, making the lower end a noted harbor for boats from the Ohio in the ice season. Another peculiarity of the river is the considerable number of tributaries which are navigable for fifteen to thirty miles of their course. Seven such are named and there are others. The width varies from 300 to 600 feet and the banks are bold, with an abundance of timber and stone for the building of dams, etc.

The structures that have been built were well done, the locks being 150x36 feet, which is, however, too small for present requirements. The State attempted to repeal the act of transfer to the company, but the Supreme Court decided such action illegal. It at the same time said that the State could, under the demand of public necessity, resume control by paying a just compensation. The State in 1886 ceded the dams and locks to the United States on condition that it extinguish "the claim of the company to exact tolls and control the river."

The evidence taken goes to show that these streams are the natural outlet of a country rich in mineral and agricultural wealth, but that they are virtually closed to competition by the prohibitory tolls exacted by the Navigation Company. The value of existing commerce is given at \$6,000,000 per year.

The money value of benefits to accrue by a release from these tolls is estimated at \$30,000 per year and the intrinsic value of the works at \$350,000.

The Board, therefore, reaches the following conclusion :

The Board is of the opinion that, in justice to the country tributary to the Green and Barren Rivers, the present obstructive tax on its commerce should be removed, and it is also of the opinion that the commercial importance of these rivers is sufficiently great to justify the general Government in extending aid to their improvement.

There appears to be three methods by which the general Government can secure control of the Green and Barren Rivers and their works of improvement :

(1) By purchasing the chartered rights on the most reasonable terms the Green and Barren Rivers Navigation Company will accept, as provided for by the act of the Kentucky Legislature.

(2) By condemnation, with just compensation, as determined by the proper legal tribunal. This method is also contemplated by the act of the Kentucky Legislature, which cedes the works to the United States on condition that the claims of the company are extinguished by purchase or otherwise.

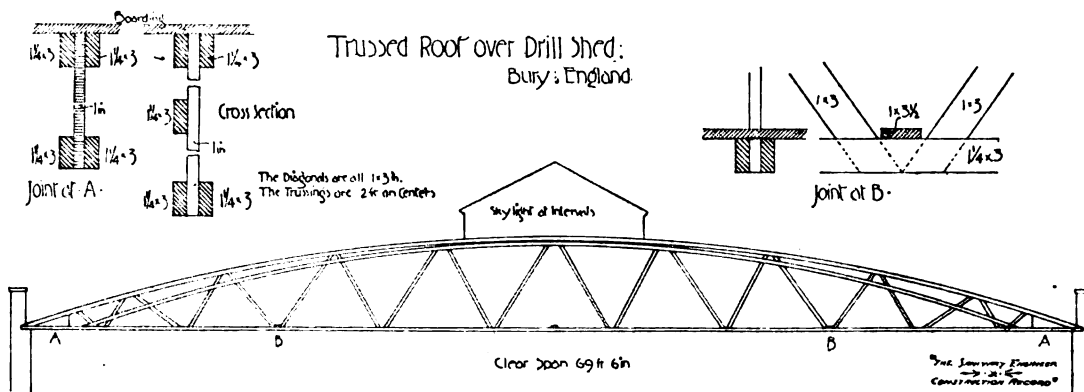
(3) By accepting the works and assuming control of the improvements of the Green and Barren Rivers, on the condition that the State of Kentucky will first extinguish the franchise, as suggested by the State Court of Appeals. On such a basis, the Board is of the opinion that the interests involved are sufficient to justify the general Government in reimbursing the State in an amount not exceeding \$350,000, the estimated present intrinsic value of the works.

PURIFICATION OF WATER BY AERATION.

THE Hoboken, N. J., Water-Works, where the process of purification practiced has been that of pumping air into it under high pressure, recently found that the water in the reservoir was troubled with the growth of algæ during the warm weather of this summer in spite of the aeration of the water in the force-main. The experiment of aerating the whole body of water in the reservoir is now being tried, under advice of Professor Leeds, who is understood to have suggested the aeration in the main, which has proved ineffectual in the late excessive heat. Perforated pipes have been laid in the bottom of the reservoir, and air pumped through them, "converting the whole reservoir into a boiling spring," as is stated in some of the reports. This has, in its turn, been effective in purifying the water. The cost is not given.

MAYOR HEWITT has reappointed Mr. James S. Coleman Street Cleaning Commissioner for another term of six years, writing a well-deserved and complimentary letter in which, after recognizing the difficulties the Commissioner has had to contend with in keeping the streets of New York clean, by reason of the occupancy of many of them by trucks and vehicles of all sorts, and the constant eruption of others by the steam, gas and electric-light companies, which makes it impossible to secure pavements that can be cleaned, the Mayor says :

"I believe that you are more anxious to render efficient service and make a good reputation than you are to get the salary which the law awards to you. I have, therefore, concluded that you are the fittest man to hold the position which you occupy, and I therefore announce to you that after the most careful deliberation and patient examination, I think you have earned the reappointment which I gladly make as due to your devotion to the public service."



NEWARK BAY IMPROVEMENTS.

LIEUTENANT GEORGE MC. DERBY, Corps of Engineers, has submitted his annual report upon the river and harbor improvements under his charge in New Jersey. A survey of Newark Bay disclosed the existence of another shoal about one mile below the one surveyed in 1884, about 800 feet long and having a least depth of 8.06 feet in the channel. It is not deemed advisable to extend the dyke beyond the length already constructed until positive evidence is obtained that the dredged channel across the shoal will not maintain itself alone. It is suggested that \$100,000 can be profitably expended during the next fiscal year.

BRITISH CORRESPONDENCE.

I NOTICE that in a few of the steam-cranes used for hoisting material, etc., for new buildings in London, that wire rope is being used in place of chains. There is, of course, less friction and the travel is easier.

During a very severe fall of rain consequent upon a thunder storm the main sewer crossing the Metropolitan Railway at Baker Street Station burst, and the line was flooded over the metals to the height of the platform, completely putting a stop to the traffic. The rainfall itself was also sufficiently heavy to stop the traffic at Farringdon Street Station on the same line after 8 o'clock. This is the second occasion within the past two years that such a mishap has occurred, the previous occasion having been at the Sloane Square Station.

An insurance company is in existence in Frankfort-on-the-Main, organized for the purpose of guaranteeing insurance against damage consequent upon burst water-pipes or defective water-fittings. The rate of insurance is about 9 1/2 d. (19 cents) per £100 insured, and the company is, apparently, well patronized. It is estimated that accidents consequent upon this cause of leakage or overflow are about a hundred times as frequent as accidents by fire.

OUR SPECIAL ILLUSTRATION.

A HOUSE IN CAMDEN, N. J.—WILSON EYRE, ARCHITECT.

OUR DETAIL SHEET.

OUR illustration this week shows details from a house at Dorchester, Mass., built about the year 1800.

BUILDING CONSTRUCTION DETAILS.

No. VI.

(Continued from page 68.)

IT sometimes happens that a piece of construction may be carried out by rule-of-thumb, or even without any rule whatever, in such a manner as at first glance to seem ut-

terly impracticable, and still be perfectly secure and trust worthy as far as it goes. An example in hand is the trussed roof, if such it may be termed, over the cavalry drill shed at Bury, England, a diagram of which is reproduced herewith. The space to be covered by the roof is 69 feet 6 inches by 106 feet. It seems almost impossible that for such a span a roof could be constructed with no timber in it heavier than 1 x 3 inches. But that is actually what has been done. The entire roof is made with 3-inch strips nailed together to form trussed rafters of the shape shown by the drawing. The top and bottom chords are doubled, the oblique pieces are but one inch thick, and the inner bowed chord is simply nailed on one side of the obliques. The feet of the chords where they meet are joined by a web of sheathing boards. These trussed rafters are spaced two feet on centres, and besides being firmly braced laterally by the roof-boarding which is nailed directly to them, they are further stiffened against yielding sidewise

by being connected at three points by 1 x 3 1/2-inch strips nailed across the bottom chords. The roof is constructed entirely of pine, and has an ordinary tarred composition covering, with light wooden skylights at intervals.

Perhaps it is hardly fair to speak of this roof as having been laid out by rule-of-thumb. The lines are just such as are often adopted for heavy bridge-trusses, and indeed a better form could hardly be devised for producing a light, stiff truss, with no waste of space or material. The total rise is but six feet, and the trussed rafters are so light that four men would easily be able to lift them into place without the aid of a derrick, as each rafter contains only 136 feet of lumber and would weigh less than 300 pounds. And it is quite possible that the rafters were scientifically calculated and the pieces carefully reduced to an exact minimum, though in the absence of certain information to the contrary one would more naturally infer that the roof was built by a clever mechanic who had plenty of 1 x 3-inch stock on hand and at a venture used it in imitation of some well-known truss.

The margin of strength in such a trussed beam is of course quite small. The weight of a single rafter is 300 pounds. The weight of the roof-boarding over a single bay would be also about 300 pounds, and allowing an equal weight for roofing composition and a section of a skylight, the total dead load on a single rafter would be 900 pounds. For purposes of rough calculation, apply the formula which Trautwine gives for trusses, on page 270 of his hand-book :

$$W = \frac{8 A d C}{l}$$

when W = total distributed breaking load in pounds, A = area of bottom chord, d = depth in inches, l = clear span in inches, and C = the ultimate tensile strength of the material per square inch, in this case 10,000 pounds. Substituting the values we have

$$W = \frac{8 \times 3 \frac{3}{4} \times 72 \times 10,000}{12 \times 70} = 25,714 \text{ pounds.}$$

With a factor of safety of three, this allows 59 pounds per foot for snow, wind, and other extraneous pressure. In reality not less than six would be admissible for the factor of safety in such a case as this, but as a matter of fact, the roof would seem to be strong enough for all it ever has to bear, for, in the place where it is built, neither snow nor wind would ever be sufficient in quantity or violence to cause any disturbance, though such a construction would not outlive a single winter in our climate.

This cannot be called good construction, being entirely too flimsy in its nature to stand for any length of time unless carefully watched. The strength, or rather the holding together of the rafters, depends chiefly upon the nailings, and, as we believe, there is but a single nail to each end of a diagonal, the chances of failure are quite large. But, at the same time, the roof is so daring and so light in its construction one cannot but feel interested in it; and, under similar conditions, a roof might be constructed which would require but little more material and be thoroughly substantial in every respect.

This roof was standing in good order in 1870, when it was measured by Mr. C. F. Weeks, architect, Boston, to whom we are indebted for the data from which the drawings were made. We are unable to say whether it still remains intact, but should not be greatly surprised to know that a broken nail or an unusually violent storm had caused its ruin.

RECENT SEWER CONSTRUCTION.

No. IX.

(Continued from page 378.)

CHISWICK SEWAGE-WORKS.

[Prepared for THE SANITARY ENGINEER AND CONSTRUCTION RECORD by Joseph Hetherington, Resident Engineer.]

THE bearing of the agitator is designed to exclude grit, and is shown at Fig. 16. Notwithstanding the rapid movement, the lime and solids in the sewage rapidly forms a deposit on the machine to a thickness of three inches and more. On placing some of this in a warm atmosphere it melts and runs to slush like snow. The agitators and mixers are driven by a small vertical engine in the engine-house. The lime-mixers revolve about ten times per minute. Their peculiar

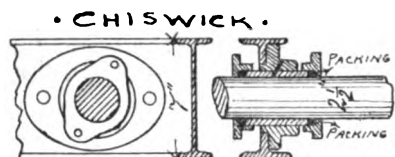


FIG. 16. BEARINGS OF SEWAGE AGITATORS

shape and construction were to some extent due to other fixtures of which they were made part. These were for mixing the lime and sulphate of alumina by hand and have been abandoned. By them the two chemicals were mixed together and an intermittent supply sent down pipes to the bottoms of the engine-wells. Dr. Tidy being called in condemned that system, and the newer agitators and mixers were put in by Mr. Strachan to give effect to Dr. Tidy's advice. He also advised that between the addition of the lime and the addition of the alumina, an interval should be given, and in accordance with this, Mr. Strachan put in the winding channel, giving the sewage a run of 300 feet, at the end of which the alumina is added. The alumina is in the form of slabs, perfectly soluble, and it is added in solution, prepared by filling a tub with a perforated bottom with slabs, and spraying a jet of water over them. The solution drains out at the perforations and is distributed over the stream, which then receives another stirring by a precisely similar machine to that used for stirring in the lime. The second agitator is situated in the mixing-house, through which the winding channel passes. (See general plan Figs. 2 and 17.) The quantities of chemicals used will be referred to presently.

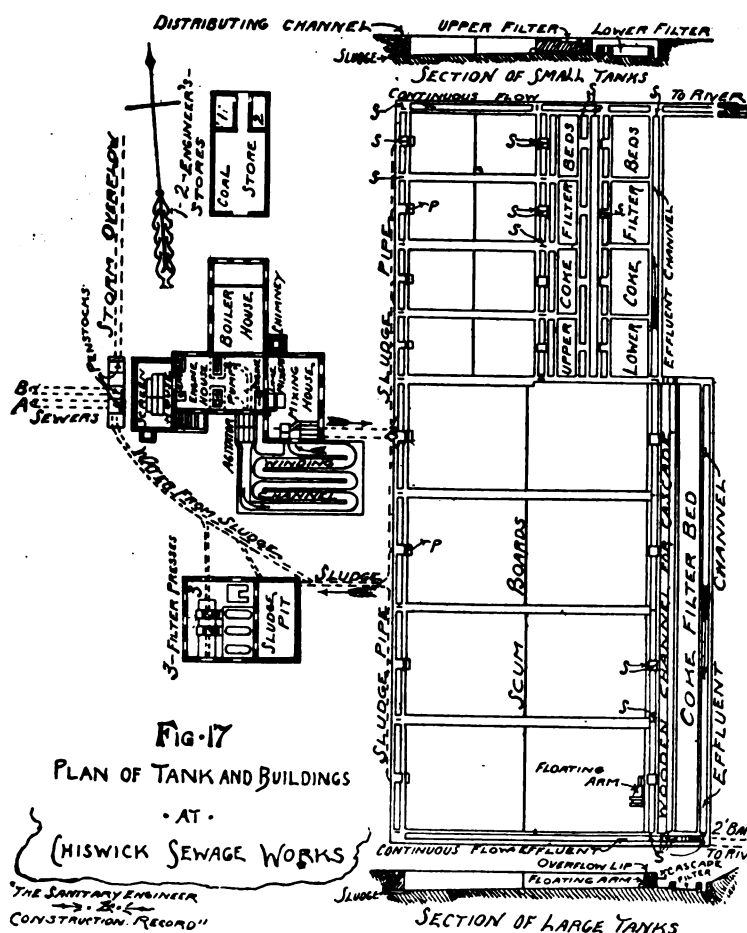


FIG. 17

PLAN OF TANK AND BUILDINGS

• AT •

CHISWICK SEWAGE WORKS

The sewage, after passing through the alumina agitators, is conveyed by an underground pipe to the distributing channel of the tanks, entering at the point A, Fig. 17. The channel extends the whole length of the eight tanks, and a wooden sluice-door to each tank admits sewage to any one of them. The channel is also fitted with sluices

at right angles placed between the tanks, and with sluices at its ends opening to channels along the outsides of the end tanks. By aid of these, and similar doors in the channel at the right-hand ends of the tanks, a continuous flow through either set of tanks can be worked. (Some of the sluice-doors are marked S in Fig. 17.) This sewage can be sent into the first large tank at A, back through the second, back again through the third, and brought back again through the fourth to the channel at the left, whence by opening the end sluice it can be sent along the channel at the side of the fourth, and thence to the river if it is high water. If the tide is out it can be turned along the wooden channel and allowed to fall in a cascade into a trench below and out to the river via the coke filter-bed. The small tanks can be worked in a similar way, and also in a great variety of other ways, as they are provided with an intricate set of channels, sluices, and filter-beds. There are eight sluices to each of the small tanks, and four to each of the large ones. The four small tanks are admirable for experimental purposes, but in practical working the whole intricate set of channels and filters is ignored. The continuous flow system is also only used on the very rare occasions when the tide is too high to allow of the use of the low-level filters concurrently with a prolonged rainstorm. This contingency has only occurred once in the past five years, when all the tanks were full and the tide was up. The ordinary method is to fill a tank at a time, shut it off, and go on filling another. Each full tank is allowed about two hours' complete rest, and the effluent is then drawn off by a floating arm, passed through the lower filter-beds, and out to the river. The filter-beds themselves have also fallen into disuse since the revolving screen was put in. The filters to the small tanks can each be used separately, but the large tanks have one long bed only. The side walls of the filter are perforated at the bottom, and by this plan only a layer of coke on the bottom of the bed came into contact with the sewage. When in use they were filled about two feet deep with coke, which, after remaining some three months, was removed and used as fuel for pumping. The smoke from the chimney-stack had a disagreeable odor in consequence, and this contributed to the disuse of the filters. A plank 9x4-inches is extended across each of the tanks, and is floated in grooves at the sides as the tank fills. The object of this is the prevention of scum getting to the floating arms. The floors of the tanks slope to the left, and a pocket is made at p, in which the sludge-valve is fixed. The sludge is swept down towards this, and passes into a pipe which delivers it into the sludge-pit. A tank is cleaned every day. The walls between the tanks are three feet thick, made of a brick casing nine inches thick, and the space filled with concrete. The floors of the large tanks are of concrete, of the small ones brick paving; and the filter-beds throughout are paved with bricks. The effluent, by continuous flow, can be discharged at 18.6 above O. D., the highest tide on record being 17.6 O. D. The walls on the south sides and east ends of the tanks, where there is least sunshine, have a tendency to grow green, and much scrubbing is necessary to keep them clean. The following are the leading dimensions of the tanks:

Large Tanks.—Length, 94' 6"; width, 40' 4"; depth 6' 0" to 7' 0" = 24,755 cubic feet = 154,844 gallons each.

Small Tanks.—Length, 50' 0"; width, 23' 6"; depth, 6' 0" to 7' 0" = 7,637 cubic feet = 47,734 gallons each.

Total tank capacity, 810,312 gallons; total tank area, .46 acre.

The sluice doors for the channels are made of wood; the frames are of oak, with angle-irons in the grooves to carry the cross-bar, also of iron. In this bar is mounted a gun-metal nut operated by a hand-wheel, which lifts and lowers the door by a screw. The frame is built flush in the brick-work of the channels.

Figures 18 and 19 illustrate the floating arms in the small tanks. They are made of galvanized iron one-sixteenth of an inch thick, and raised by drums of the same material. The drums are much too large, and are all half-filled with water. The lower end of the arms pivots into an iron valve-box, which is fitted for a 9-inch pipe, through which the effluent is passed below the upper filter-

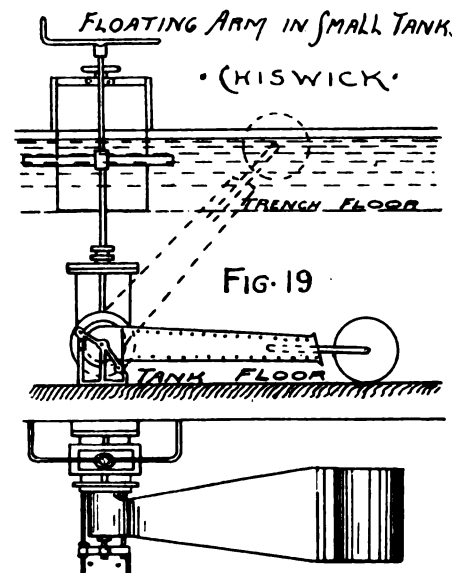


FIG. 18

beds. The operation of this detail will be readily understood from the figures. The arms in the large tanks, Figs. 20 and 21, are on the same principle, but differ in construction. They are made to draw the water off much closer to the sludge, a depression being made in the tank-floor for this purpose. The floats are two rectangular boxes, pivoted at the top lip of the arm. These floats are made of galvanized iron, and have a 15-inch outlet-pipe. Fig. 21 illustrates a difference between the large and small tanks, in the former having an overflow-lip made by lowering the wall at one side of the trench by six inches. When used in continuous flow working, the water wells over the lip and drops into the channel behind. A sluice-door is provided also, and the flow can be sent that way instead of over the lip. The sludge-valves are at the left-hand ends of the tanks, Fig. 17, and are the same valves as for the floating arms, and are worked from the top. The tank-floors fall a foot in their length, and in the large tanks six inches towards the centre as well. When a tank is to be cleared of sludge the walls are first scrubbed all round; the water left by the floating arm on

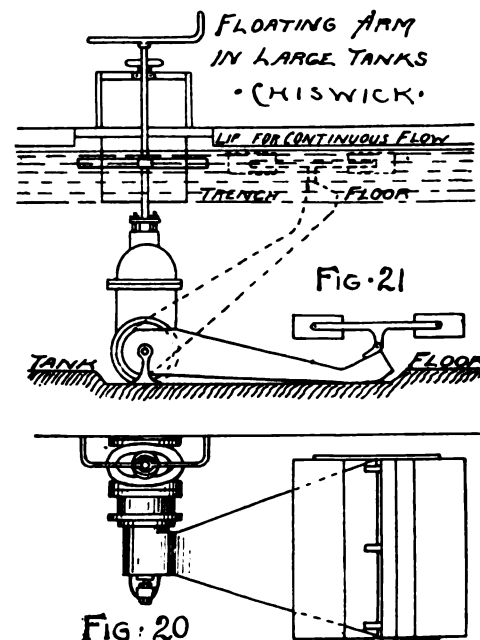


FIG. 20

the top of the sludge is then run back to the sewer by the same pipe that takes the sludge, a shunt being provided in the pipe to deflect its flow either to the sewer or the sludge-pit. Finally the sludge is pushed down by manual labor towards the valve, and delivered into a pit ready for pressing.

Like many other precipitation-works, Chiswick works had the sludge difficulty. It was at first deposited in earth-pits, there to dry by evaporation and percolation. The latter process was soon stopped by the glutinous

sludge making the ground water-tight, and evaporation being very slow, the available space began to get short. The odor from the beds was powerful and roused the neighborhood, resulting in a Chancery suit. Practically all the sludge made between 1879 and 1884 was on the ground, and even without the goad of a Chancery suit the board would have soon had to face the question of some fresh way of sludge disposal. They had indeed met at the works and decided upon the adoption of filter-presses months before the Chancery proceedings, but the delay in waiting first for the Local Government Board to hold an inquiry and then the further delay of their sanction to borrowing the money, brought the summer round again. Notice of proceedings was served on a Saturday, and the board had the work of putting up pressing apparatus commenced with on the next Monday morning. Under such circumstances there was no time to mature plans or gain any useful knowledge of pressing arrangements elsewhere, and orders were simply given to an experienced contractor in this class of work to put up presses with all speed, according to any plan he thought would best suit the circumstances at Chiswick. The outcome of this was far from satisfactory, as will appear from the description of the plant.

The sludge from the precipitation tanks flows by gravity to the sludge-pit beneath the pressing shed (see Figs. 22 and 23). As previously stated, the top water from the sludge comes down the same pipe, and an opening is made in the pipe near its entrance to the pit. The man in charge can here see when the water begins to bring sludge, and by means of a shunt can turn the stream into the pit. After standing in the pit for a short time a subsidence takes place, some water coming to the top. This is drawn off by an arm operated by hand. It is lowered into the top water, and having drawn the liquid off is raised again. The sludge is raised by a suction-pipe connected with the two pressing vessels and with the sludge-pit. The valve to either vessel being open, an air-pump is set to work to exhaust the vessel and pipe, the sludge being thus drawn up. As it is entering a quantity of milk of lime from the lime-mixer above is syphoned over into the pipe, and the two enter the vessel together. The vessel being full, the suction-valve is closed, and the valve to the press opened. Compressed air, which has been stored in an air-vessel of similar shape and size to the pressing vessel, is turned into

der, but by making it double-acting a better distribution of work is secured. See Fig. 22, where S is the steam-cylinder, p the air-pump, and c the air-compressor. The pipes are shown in the same figure. The lime-mixer is a wrought-iron cylinder with a perforated bottom on which the lime rests. Beneath this is a conical part, into the bottom (apex) of which compressed air is admitted. The lime is thrown in and water turned on till about seven cubic feet has run in. When the lime is slaked, and just previous to filling a vessel with sludge, the air is turned on at the bottom of the mixer, causing a fierce ebullition of the contents of the vessel. The inlet of the syphon which draws off the contents is beneath the perforated bottom of the cylinder, so that stones and cinders do not pass. The pressing-vessel and press are further illustrated in Fig. 24. A shaft carrying four arms of 1-inch round iron traverses the vessel, and is kept revolving by

hind the block is filled. A clothes-peg happening to go in with the first rush will tear half-a-dozen cloths in its passage. Sludge escapes at the rents, gets behind the cloth, and blocks up the corrugations in the plate, and the press works slowly from want of drainage. In any case, the corrugations clog in time with the finer particles which escape through the cloths with the first rush of water. This ceases when a layer of solids has formed in the cloth. The plates are cleaned at the time the cloths are changed. At first cloths of jute supplied by the makers of the presses were used. These were estimated to last three months, but in practice they were always found completely rotten in three weeks. With jute, too, it cost £4 10s. to clothe a press, as each cloth cost 3s. 9d. Flax cloths were then tried, made up on the works at a cost of 2s. 4d. each. These always last one month, without a tenth of the trouble and patching the jute re-

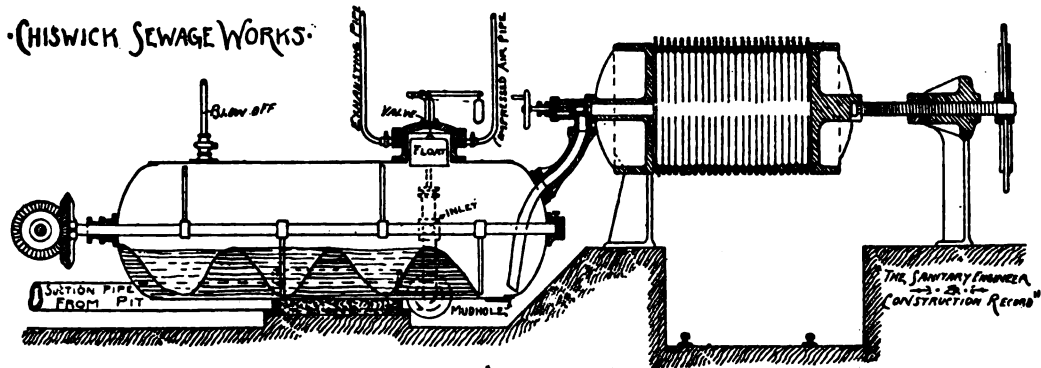


FIG. 24 SECTION OF MONTEJUS' AND FILTER-PRESS

the engine. It does not prevent an accumulation of sludge forming along the bottom, as shown by the dark shading. Between the dams of heavy solids are spaces which remain filled with water. The vessels have a capacity of 100 cubic feet each, equal to $5\frac{1}{2}$ times that of the presses, this being the proportion wet sludge bears to cake, but owing to their horizontal position all the contents can never be expelled, as will be seen by a reference to the figure. On the average each vessel has to be filled three times to make two presses full of cake—often twice filled to make one press full. The shafts wind on to themselves rags, hair, etc., and further diminish the contents of the vessels. They require cleaning out frequently, and a man has to get in every time to get the shaft clean. A small mudhole is put in the bottom of each vessel to wash out at. The loss of time and of energy in the form of air blown to waste is simply enormous. It is seldom that a vessel can have a charge of sludge drawn into it in ten minutes; often it takes fifteen. Not less than four hours every day is wasted in this way, while the engine is running all the while and the men's pay going on. The average working hours of the men are between fifteen and sixteen per day. Instead of two men two-thirds of their working time, as was estimated, it takes two-thirds of their existence. The consumption of coal is very heavy. It is not easy to get at, as

quired. The Chiswick presses have twenty-four circular plates; these give less filtration area than square plates of the same width, but square plates are apt to squirt unless some other means than a central screw is used for closing the press. The screw as used at Chiswick is rather a barbarous method, for the friction on the end is immense, and the straining of the men in closing the presses is painful to witness.

The water expressed from the sludge is taken back to the sewer and pumped up with the sewage. Much of the sludge is taken away by market gardeners for manure, but no payment is made for it. If allowed to accumulate in a heap it heats and gives off a most offensive odor, but this may easily be prevented by covering up the heap with earth.

It is a little singular that filter-presses were not generally adapted long ago at works where the sludge difficulty had to be faced. Their usefulness was proved some thirty years ago at Leicester by Mr. Wicksteed. In a patent specification, dated 1856, a filter-press is described, "which may be applied to express water from sewage matter, whereby a cheap and valuable manure is formed." The number of patents taken out for filter-presses since that time is extraordinary. Like other machines, ninety-nine out of every one hundred patents concerning them are useless. There is one that might well be put in practice—viz., to close the press by hydraulic pressure instead of screws. Hydraulic power might also be applied to force in the sludge.

The description of the works is now completed, but before giving diagrams of flow, etc., a few words may be permitted on the necessity of competent supervision of the machinery during its manufacture and erection. Chiswick plant illustrates this very well. Take the pumping-engines for example, on the efficiency and constant readiness of which the immunity of the town from sewage-flooding depends. The design of these engines is exceedingly ingenious and compact, but the details have been carried out in a slovenly manner—with very expensive results to the ratepayers. The cylinder covers are fastened on by $\frac{3}{4}$ -inch bolts in 1-inch holes. When a cover has to be removed the bolts are run round in the holes, and, in order to get at their heads, the wood-lagging has to be removed. Thus an operation requiring only minutes occupies hours. Competent supervision would have insisted on a better arrangement. Down the pump-well numerous instances of a worse kind occur. A piece has been drilled out of every pump-barrel immediately over the lower valve to form a mudhole. This may have been necessary, but some compensation should have been made for the metal removed in so dangerous a place—dangerous because the valve has a conical seat and acts like a wedge in the barrel. Already one has split from this cause and has had to be removed. The pumps rested on the brick floors of the

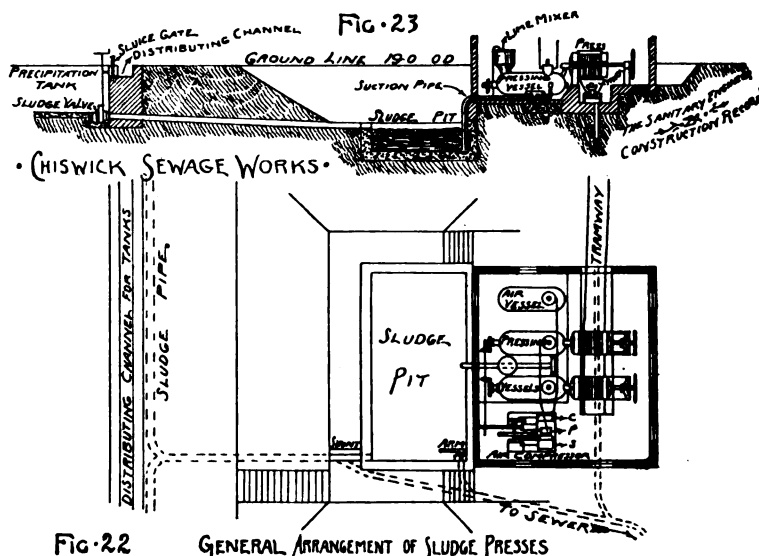


FIG. 22 GENERAL ARRANGEMENT OF SLUDGE PRESSES

the charged vessel and the sludge driven into the press. The charge having been expelled and the press filled with cake the press-valve is closed and the charge of compressed air which now occupies the place of the wet sludge in the vessel is blown out to atmospheric pressure, the air-pump is set to work, and the operation repeated. When the press is opened the cakes drop into a truck underneath the presses to be removed outside. Compressed air is supplied by a horizontal air-compressor, supplying one-third of a cubic foot of air at atmospheric pressure at every stroke. The air-pump is worked by the same engine. In this air-pump the piston is made to act both on its in and out stroke. The cylinder of the air-pump has a port in the middle of its length, and each end is a valve. When the piston passes the port, the air enclosed is expelled by the valve at the end. A further portion of air expands into the cylinder, and when the piston passes the port on its return stroke the enclosed air is again swept out at the other end. The result is the same as if the piston were single-acting and the air admitted at one end of the cylin-

der, but by making it double-acting a better distribution of work is secured. The steam is supplied from the pumping-engine boilers, but it is not less than $4\frac{1}{2}$ tons per week. This is $3\frac{1}{2}$ times what it ought to be with a well arranged plant worked by compressed air, perhaps the most extravagant that can be devised. Every time a vessel full of compressed air at 120 pounds is blown off, about $3\frac{1}{2}$ millions of foot-pounds are absolutely wasted. The chambers of the presses are 36 inches diameter, and each press contains about 18 cubic feet, the charge of cake in one press weighing about 10 cwt. About 8 pounds of lime is used to each hundredweight of cake. Gray-stone lime is used for this purpose, the Clay Cross lime used in treating the sewage being far inferior for the purpose. Without lime it is impossible to press a firm cake. Clay Cross and chalk limes make the cakes like soft-soap, and much scraping is required to get them off the cloths. With gray lime cakes drop out of the press like boards. Where the sewage is badly screened, masses of rags and such like matters get impacted in the hole through the plates, and only the part of the press be-

wells, and were held down by girders, which were built over lugs on the barrel. (See Fig. 25.) This arrangement was strong to hold the barrel down, but weak to hold it up when the bricks were pulverized at the bottom of the well. Consequently, several lugs broke off, and the downward motion of the pumps being arrested by the delivery pipes, one of these snapped off at the throat, needing another new barrel. The carrying arrangement

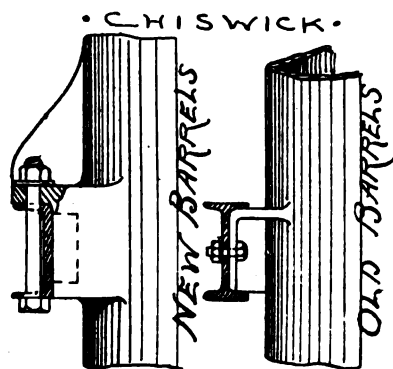
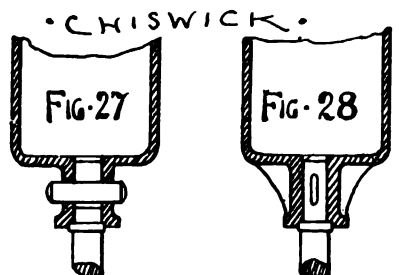


FIG. 26

FIG. 25

shown in Fig. 26 has now been adopted, and the floors of the wells cut out and oak planks six inches thick laid in, over which again iron plates one-quarter inch thick and three feet square have been placed for each pump to rest on. The new lugs permit the barrels to be drawn out without cutting the girders out of the walls. The exhaust-pipes were made with lead joints, which worked leaky from the jarring and rocking of the condenser, also carried on the same girders as the pumps. The strains set up in the condensers by the breaking off of the lugs on the main pumps broke both engines' condensers. These have been replaced by larger ones which admit the exhaust-pipe by a gland, allowing expansion and contraction of the pipe without pulling the joints apart, as was the case with the old condensers. The delivery pipes were connected by lead joints, always leaky from the movement of the pumps. Flanged pipes have been substituted for these. The injection-pipes to the condensers were made with lead joints in such positions that calking was impossible and leakage (air-drawing) incessant. They have had to be replaced by screwed pipes. The rams were made in design as shown in Fig. 27. Several had their ends pulled out by the heavy



OLD RAMS

NEW RAMS

valves they have to carry, and new ones made as in Fig. 28 are substituted. The rams are always full of putrid sewage which leaks in through the hole for the valve spindle. Other defects might be mentioned, but enough has been said to show how essential a competent inspector of machinery is in such work, where so much depends on its good working order. The engine in the pressing-shed affords another illustration which should be laid to heart by local authorities. This machine was repeatedly denounced by the resident engineer in the course of its construction, but owing to the great need of its work being commenced as early as possible to comply with the Chancery order, the only thing that could be done was to require a guarantee for six months from the makers. They gaily offered to guarantee it for twenty years, but after working six weeks only, it was admitted by these gentlemen themselves to be in such a bad state that it would be cheaper to them to put in an entirely new engine, rather than attempt to fulfill their guarantee of the old one. This they accordingly did, stopping the work a whole week to put in the new one. Without a competent person to point out the defects in this machine, the original guarantee of three months would have been shuffled through in all probability, and the board would have possessed a machine at once a source of danger in Chancery and a curse to those who had charge of its working. These things should be a lesson to other boards who lean too much on the civil

engineer whose design for the works they have accepted. Clerks of works are provided for brick-work, and there is equal need for a similar functionary in machinery. Such a one would have saved Chiswick great risks as well as some hundreds of pounds.

Since 1883 the flow of sewage has been recorded daily, as also the rainfall and the height of the tides (both of which affect the flow); and from February, 1885, daily records have been kept of the sludge turned out of the filter-presses. In the spring of the present year the height of the water in the subsoil has been daily observed, but the observations are not sufficiently extensive to warrant any deductions. Movements occur in the ground-water level, and the leakage appears greatest when the water is highest—and that is all that can be said now.

Sheets are kept in the engine-room in which are set down the height of the sewage in the pump-well, and the time of starting and stopping the pumps. The sewage is not pumped below one foot over the inverts; when that level

is reached the pumps are stopped, and they stand till the water rises to about four feet. These particulars are graphically set out in diagram form every week, as shown in Fig. 29, where two days are taken from actual records—the first a dry one and the second a wet one, with a rainfall of .98 inch. The time the engines are at work is shown by black lines underneath, and the flow put down in figures below. It will be observed that on the second day the sewage rose with great rapidity against one engine, and even against both engines together. There was, however, a heavy subsoil leakage going on at the same time. There is a storm-overflow for a case of this kind, it is true, but so long as the pumps can hold the sewage below eleven feet it is not to be used. It can only be used when the tide is down in any case. Storm-overflows have furnished occasion for much sus-

picion on the part of certain persons who know of their existence. Dark hints are thrown out about their surreptitious use in the night, either by authority to save expenses, or by the workmen to save themselves the trouble of pumping and treating. For the past five years and a half, at any rate, Chiswick overflow has not been used. It is kept locked and no one can open it without the knowledge of the engineer.

To return to the record of the flow—the weekly diagrams are combined into a yearly one, where the curve is determined by the number of gallons pumped each day. The rainfall and tides are entered in this one also, as shown in Fig. 30. In this diagram, the flow is divided into two parts, the dry-weather flow (sewage proper) and rain, and leakage. The first part is shaded in Fig. 30 with full lines, the second with dotted lines. The flow is put down in figures, as also the rainfall and heights of the tides in the spaces under each section.

The sewage proper is ascertained by striking an average of the summer flow when leakage is at a minimum. In 1883, this average worked out to 28.3 gallons per head per day. The population has increased from 17,000 at that time to 20,000 in 1886, but the sewage flow per head does not increase in the same proportion, because one large factor is constant—namely, the sewage from two large breweries. The sewage flow is now estimated at 25 gallons per head, equal to 500,000 a day of sewage proper. In 1886 the total flow never fell below this figure on any days except Sundays, when the flow falls off by about 90,000 gallons on the average. The excess over 500,000 after excluding that due to rain may be put down to leakage, which is never absent at Chiswick.

The quantity of water due to an inch of rain is in round numbers 1,000,000 gallons. Its amount is ascertained by taking the average flow of a number of consecutive dry days, and noting the increase which occurs on the wet day. Favorable opportunities for this occur several times in each year. Thus in March, 1885, the average flow for 14 consecutive dry days was 625,450 gallons. This dry period was broken by a fall of .48 inch of rain on the fifteenth day, the flow being increased to 1,173,120 gallons. Deducting the average of the preceding 14 dry days, leaves 547,670 gallons due to .48 inch, equal to 1,140,973 gallons for one inch. By a like process, a fall of 1.37 inches in June gave an increase over the then dry-weather average of 1,268,970 gallons, equal to 926,255 gallons for one inch. From a number of similar instances, the resulting average is in round numbers, 1,000,000 gallons for an inch of rain at the present time. In 1883, this quantity of rain gave an

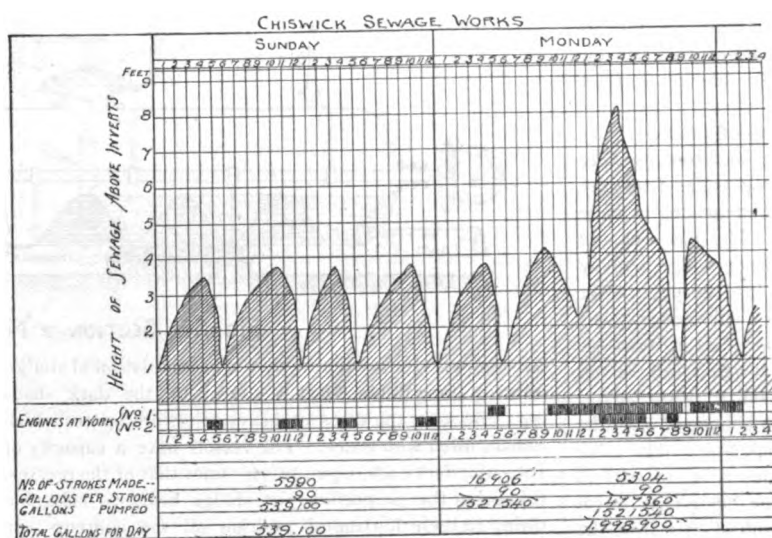


FIG. 29. FORM OF WEEKLY DIAGRAM OF SEWAGE FLOW AND WORK OF PUMPS

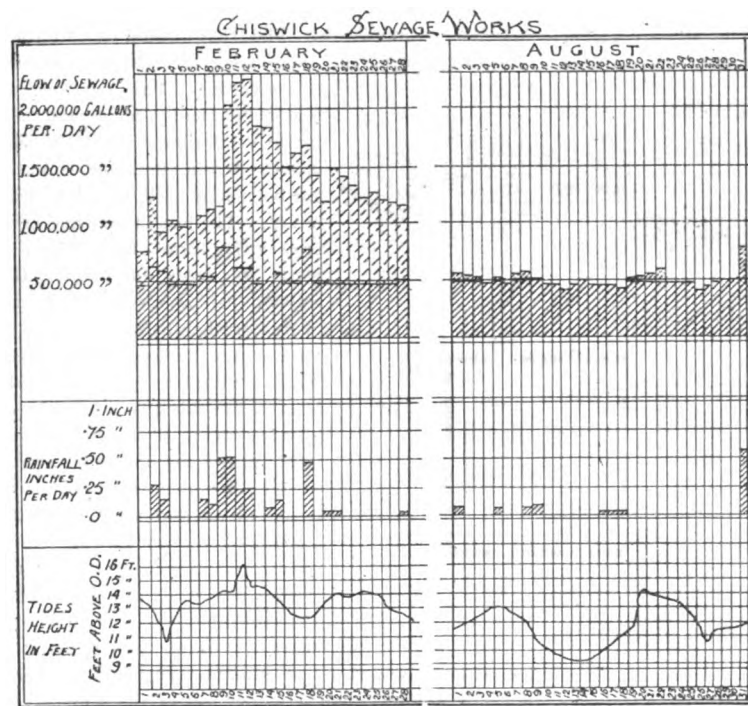


FIG. 30. FORM OF YEARLY DIAGRAM SHOWING SEWAGE FLOW, RAINFALL AND TIDES.

increase of 645,000 gallons, which has risen to 1,000,000 by the additional houses erected since that time, and by some road-water being admitted. In Fig. 30, the months of February and August, 1883, are illustrated, as they show in a marked manner the excessive leakage in the Chiswick sewers. The dry-weather flow is taken at 482,126 gallons, and to this is added an amount for rain in the proportion of 645,000 gallons for an inch. All above the resulting line is leakage. It will be noted that the August flow is frequently below the average dry-weather flow of that year, and also that the tidal curve influences the sewage curve above. These diagrams are over five feet long and one foot high, and they show, when colored, the fluctuations in sewage flow in a very graphic manner.

Whence comes the enormous leakage? A part is directly due to the tide, which gets into the sewers in some un-

known way whenever the tide rises above 14 feet O. D. The leakage is heaviest when the average height of the tides is highest, and then also the subsoil water is highest, since the latter responds readily to the tides. Thus in the two months shown in the figure the average height of the tide in the first was 13 feet 2 inches, and in the second 17 feet 5 inches above O. D. In the second month may be seen the effect of the tide about the 7th and 21st, when the springs occur. The same thing is observable throughout the year, and if the tides run high or there is a heavy flood in the river for several days the leakage rapidly increases.

When the leakage is as great as in the February illustrated, the sewage is as clear as drinking-water in the early morning. During some of the heaviest days the flow was 135 gallons per head of population. It will be understood from what precedes that the annual flow is very variable. In 1883 the total flow for the year was 253½ millions of gallons; in 1884, 208½ millions; in 1885, 256½ millions; and in 1886, 280½ millions.

The treatment consists of the application of lime and sulphate of alumina. The lime is a chalk lime from Clay Cross in Yorkshire. Before being put into the mixers to form the milk-of-lime, it is thoroughly slaked into the form of a damp powder. The quantity used per gallon averages about seven grains of the unslaked lime per gallon of sewage. The judgment of the workmen regulates the amount according to the strength of the sewage, more per gallon being used in the day-time than in the night.

Clay Cross lime gives the best effluent of any lime used at Chiswick. Ordinary chalk lime is very good, but contains a large proportion of large flints; gray-stone lime gives a poor result.

The sulphate of alumina is used in the proportion of five grains per gallon of sewage, on the average, the judgment of the men being relied on to regulate it to the ever-changing foulness of the sewage. It is delivered at the works in the form of slabs about 18 inches long, 9 inches wide, and 4 inches thick. The following is an analysis of it:

Alumina.....	14.00
Peroxide of iron.....	.75
Sulphuric acid in combination with above bases.....	33.81
Free acid.....	.00
Water.....	51.44
	100.00

It is guaranteed to contain 46.68 per cent. of sulphate of alumina. It has hitherto proved far superior to any of the numerous substitutes experimented with at Chiswick.

The quantity of sludge at Chiswick could only be guessed at previous to the erection of the filter-presses. The best authorities gave as results to be relied on from 120 to 140 pounds of pressed sludge per head per annum from a population similar to Chiswick. The working of the presses at Chiswick shows that these figures are far from reliable. The amount of pressed sludge is recorded every day, and may be shown in tabular form, thus:

	Tons per million actual flow.	Tons per million sewage proper.	Amount per head per annum in pounds.	Total for year in tons.
1885	8	12	245.2	2,190
1886	7.728	11.967	244.5	2,184

The cost of pressing a ton of sludge at Chiswick is abnormally high, owing to the malarrangement of the machinery. It has hitherto been about 5s. per ton of cake. The details now are:

Wages.....	£200
Lime.....	140
Cloths.....	60
Coal, gas, oil, etc.....	100
Total of pressing per annum.....	£500

The cost of chemicals for treating the sewage is about £1 10s. per million gallons. The total annual working expenses since the commencement of the works is as follows:

1879-80.....	£168
1880-81.....	808
1881-2.....	1,020
1882-3.....	1,613
1883-4.....	1,281
1884-5.....	1,500
1885-6.....	2,038
1886-7.....	2,053

A change of management occurred at the end of 1882 and at the end of 1884. The cost of the year 1884-5 includes five months' sludge-pressing. The last two years' expenses include sludge-pressing for the whole year.

The cost of the whole scheme was about £100,000, of which £26,500 has been expended on the purchase of the land and the erection of the buildings and machinery at the outfall-works.

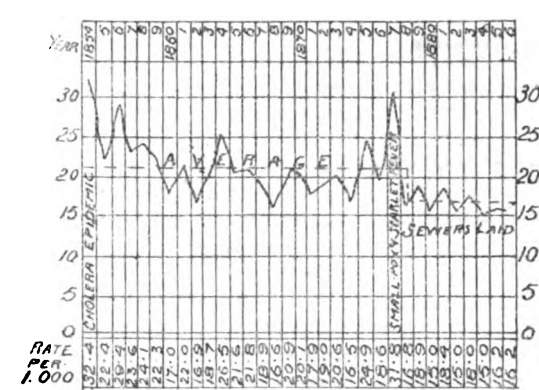


FIG. 31. DIAGRAM SHOWING DEATH RATE FOR 33 YEARS

The profit of sewage-works is not to be reckoned by the interest table, but rather by the death-rate; and, when looked at in this way, Chiswick can show a good many people now alive who would have been dead but for the drainage-works. This point can best be shown graphically by reproducing a diagram due to Mr. Strachan, which shows the death-rate for the past thirty-three years. This is illustrated in Fig. 31, with which this description may fitly close.



THE DOMESTIC ENGINEERING IN THE ARMY MESS-HALL AT DAVID'S ISLAND, NEW YORK HARBOR.

THE accompanying plan, elevation, and sections of the (new) United States Army mess-hall and kitchen at David's Island, New York Harbor, gives a very good idea of the building and its appointments, as lately constructed by Captain George H. Cook, Assistant Quartermaster, U.S.A., for the accommodation of 1,000 enlisted men.

The dining-room is 50x152 feet in plan by 16 feet high, floor of Georgia pine, the walls being 18 inches thick, of brick, with air-space, and hard plaster-finished on the solid walls, and wainscoted in white wood and white pine.

The kitchen building is 104 feet long by 30 feet wide, with a boiler-house at one end, the kitchen proper being 30x58 feet.

COOKING APPARATUS.

The cooking apparatus consists of thirteen steam-roasting ovens for meats, etc.; six cast-iron vegetable-steamers; four steam stock-boilers; one coffee, one tea, and one hot-water urn, the positions of which can be seen in the plans.

The steam-roasting ovens are of the class known as "Ashcroft's." They are each 33 inches long by 26½ inches wide over all, with double sides and bottoms, between which the steam circulates; a pressure of forty pounds giving sufficient heat for the cooking or roasting of meats.

The vegetable-boilers or steamers are each of 33 gallons capacity, with galvanized-iron baskets to hold the vegetables, and the stock-boilers are made of copper, with brass annular heaters, and each is of 80 gallons capacity, and all with copper covers. The urns are termed self-feeding Maracaibo, and are made of copper. The water-urn is 36 inches in diameter, and holds 100 gallons, and the tea and coffee urns each hold 80 gallons. They have water-gauges on the sides to show the height of their contents.

At the opposite side of the kitchen are the sinks and strainers for wa-hing dishes, etc., their position not being shown. Car-tracks from the tables in the centre of the kitchen run to a turn-table at the centre of the dining-room, and thence run down the centre aisles in both directions. The food is distributed by these cars and the dishes collected again and returned to the sinks in the kitchen.

The floor of the kitchen is granolithic and it is inclined in the direction of cast-iron drains in the floor at positions parallel to the line of cooking utensils and sinks.

No pipes are passed through the floor, and all steam return or water-pipes for the cooking apparatus are either overhead or run on or near the back wall below the kettles,

entering from the boiler-room, which is much lower than the kitchen at the corner, and, running both ways, facilitating this arrangement, as no pipes pass doors or passages.

STEAM-BOILERS, ETC.

Two horizontal multi-tubular boilers, each 10 feet long by 36 inches diameter, with thirty 3-inch tubes, supply steam for all purposes.

They are made of "Otis" best boiler-steel throughout, the shells being No. 2 American wire gauge in thickness (¾ of an inch) and the heads ⅞ of an inch.

The boilers are made with three taper-courses, the laps being backward from the fire.

The grates used are the McClave shaking grate of 7½ square feet to each boiler. In addition to the regular common safety-valve each boiler is supplied with a 2-inch nickel seat and disk Consolidated Co.'s lock safety-valve, set to blow at fifty pounds.

The dining-room is warmed by twelve wall coils, nine pipes high, of 1-inch pipe, and the store-room, cook's rooms, and bath-room are warmed with compound coil-radiators, cased, with registers in the top. The kitchen has one radiator inside the door to the yard and also a long coil of six 1-inch pipes at the back of the sinks and drain-boards to keep traps, etc., from being frozen in cold weather should the cooking apparatus be long enough out of use to let the kitchen cool. The size of the main pipes and return-pipes are shown on the plans, with their positions and the positions of their valves. The main steam-pipe is indicated by a double line, while the return-pipe is dotted. The main pipes are near the ceilings and the return-pipes are in a space between the floors and the ground of about four feet. The return-pipes and all pipes within the boiler-room are covered with Teop's asbestos and felt covering and canvas; the mains in the dining-room being uncovered.

The water of condensation is returned by gravity from the heating apparatus, and also from the cooking apparatus, but in the latter case a Kieley pump-governor and Worthington pump is introduced into the circuit in case the returns from the cooking kettles require pumping when much water has to be heated.

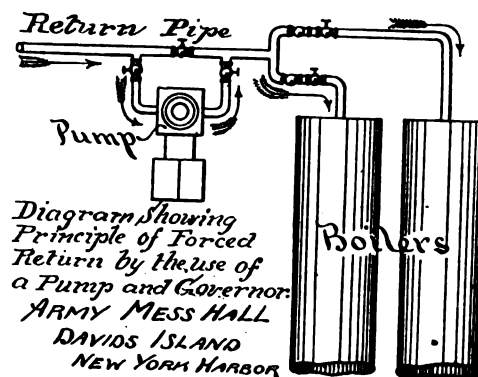


FIG. 2.

Figure 2 shows the principle involved in the return-pipe of the cooking apparatus for passing the water into the boilers by means of the pump and governor, in case it does not properly return by gravity when large quantities of cold water are suddenly let into the cooking-kettles, etc.

CISTERN AND HOUSE-TANK.

The position of the three cisterns, which are each twelve feet in diameter by ten feet high, is shown, and the course taken by the roof-waters in entering them. A pump in the boiler-room takes suction from either or all of these cisterns and forces the water into an iron tank at the highest part of the boiler-house. The water then flows by gravity to the kitchen and other parts of the building for all purposes.

A grease-trap is built in the yard into which the waters from the cooking apparatus all pass, and all other waste-waters from the kitchen pass into the same trap or interceptor for the purpose of cooling it. From this trap a rustless-iron drain is run to the water of Long Island Sound.

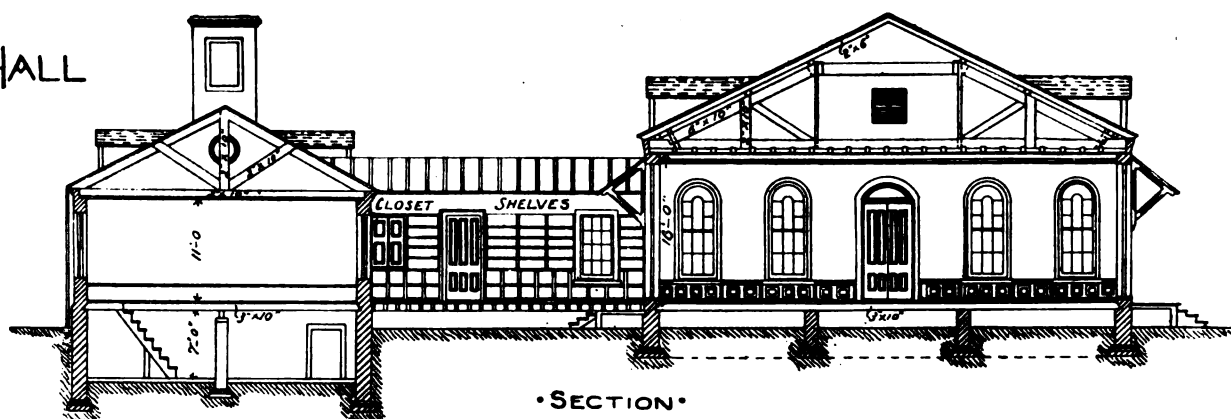
A study of the drawings, which are very complete, will show other important details to any one particularly interested in the construction of similar buildings, and there is no doubt the proprietors and builders of our large summer hotels can study this plan to their advantage and prevent making sink-holes of filth of their back door-steps. We have personally inspected the premises and know whereof we speak.

The cooking apparatus was furnished by Messrs. Duparquet & Huot, of New York.

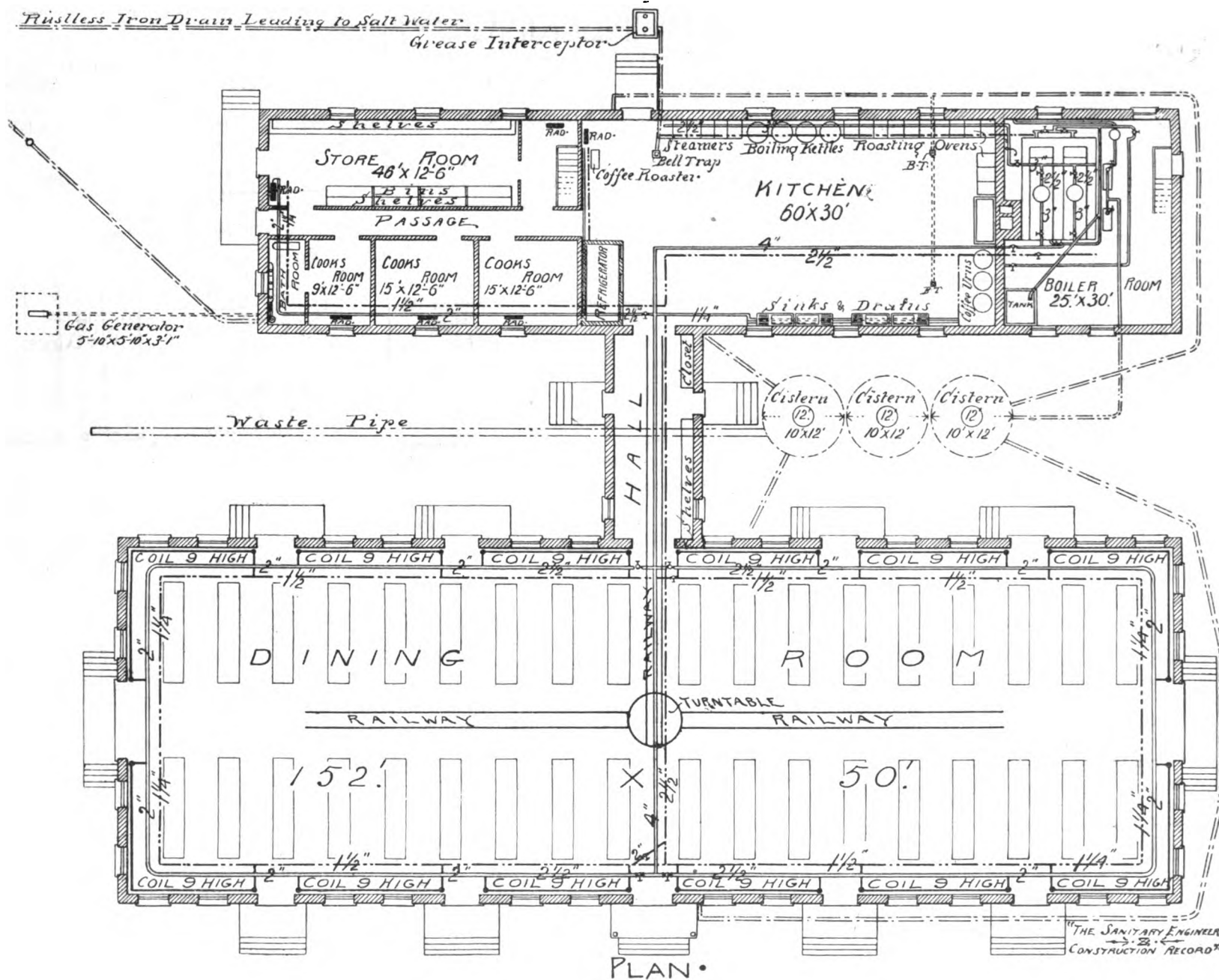
ARMY MESS HALL

DAVIDS ISLAND

NEW YORK HARBOR



FRONT ELEVATION



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. X.

(Continued from page 381.)

LET us now make Fig. 24. It is a fairly long diameter elbow, the radius being $1\frac{1}{2}$ diameters of the pipe, and into it we screw a pipe the same as that shown in Fig. 22. (Shown by the dotted lines at the edges.) Incidentally it is explained elsewhere in these articles that to double the radius of a bend is the means of

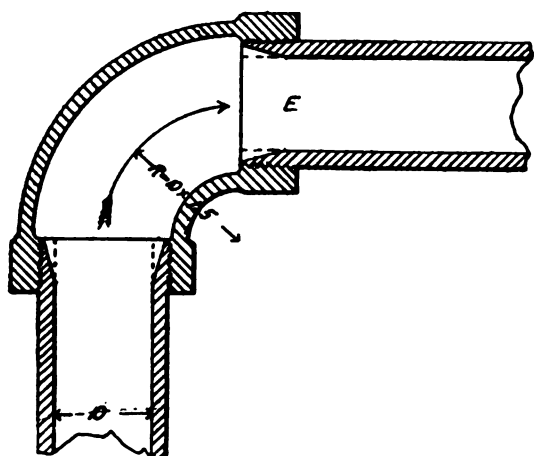


FIG. 24

lessening the head required for change of direction to about one-quarter what it would be for the shorter radius—in other words, the head required decreases somewhat faster than the inverse of the square of the radius—therefore, for change of direction in Fig. 24 we have, say, $\frac{3}{8} = 9\frac{1}{2}$ diameters, plus no diameter for entry, plus 5 diameters for friction, the elbow being longer, $14\frac{1}{2}$ diameters, to which if we add 8 diameters (as we did in Fig. 23, for the same reasons as there given), it will bring the value up to $22\frac{1}{2}$ diameters. If we go further and lengthen the elbow to 5 diameters radius, then C D will become nothing; E will be, say 8, as before, and F $7.8 = 14.8$.

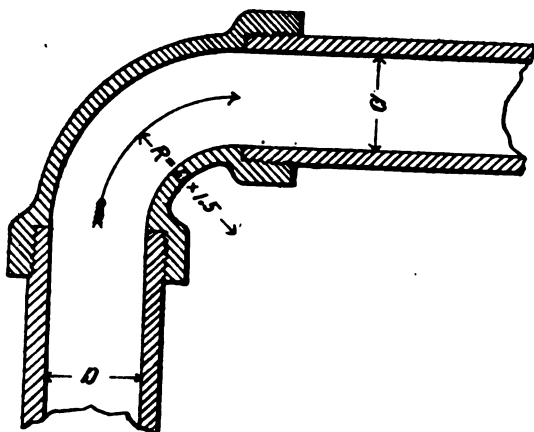


FIG. 25.

If we make one more diagram (Fig. 25) with the elbow and pipe the same diameter throughout, the radius of the elbow being $1\frac{1}{2}$ diameters, then we have C D $= 9\frac{1}{2} + E = 0. + F = 5.0 =$ total, 14.8; and if this elbow is further drawn out, so as to equal 5 diameters radius, then we have C D $= 0. + E = 0. + F = 7.8$ total.

These are approximations that I have reason to believe are not far wrong, and though not absolutely correct my apology for publishing it lies in the fact that it gives the practical man or mechanic some definite idea of what the resistance of an elbow really amounts to, and how greatly it can be lessened and made almost nothing by proper radii of elbows and easy points of entry.

With a return bend, the loss for change of direction is just double what it would be for a 90-degree elbow. The loss for entry will be no greater, but the same for similar fittings and ends, while the loss for friction will be about doubled, as the bend is about twice as long as an elbow.

The shortest elbow or bend must have a radius of one-half its diameter, and if the back of it is round, the loss of head for such an elbow is about sixteen times as great as it would be in a bend of four diameters, and eight times as great as in one of one diameter, according to "Trautwine." So that the advantage to be obtained by length-

ening the radii of common fittings for hot-water work ever so little is obvious.

Therefore, if we consider the loss of a common elbow as equal to that caused by 100 diameters of a pipe, being 38 for change of direction, 58 for entry, and the remainder for friction, the resistance of a common close and return bend will be equal to about 76 diameters for change of direction; 58 for entry into a square-ended pipe, and say 8 for friction—142 diameters.

If the radius of the bend is doubled, the 76 for change of direction becomes about 19. If an easy entry is made the 58 drops very rapidly, say to 8 again, and friction is increased slightly on account of the increase of length, giving the value say of 40—a most decided gain.

In box-coils for hot-water work it is probable that return bends of greater radii than one diameter cannot be used, but by care their resistance value may be reduced to that of 50 diameters of the same pipe. So that in an inch box-coil four feet long the length of pipe and the bend can be made to have equal values, whereas, by neglect the resistance in the bend may be increased to three times as much.

(TO BE CONTINUED.)

Novelties.

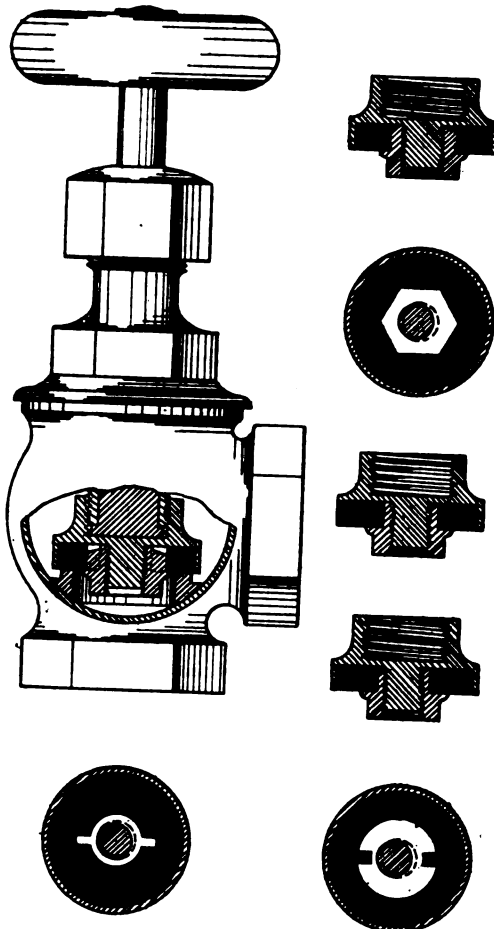
Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

MASON PRESSURE-REGULATOR.

We were not able to state who were the makers of the reducing-valve illustrated in our Novelty Column last week, page 381, invented by W. W. B. Mason. We are now informed that it is manufactured by the Mason Regulator Company, 22 Central Street, Boston, Mass.

VALVE-DISKS AND THE METHOD OF REMOVING AND RENEWING THEM.

THE accompanying sketches show late novel improvements in the Jenkins valve, or that class of valves employing a removable disk or valve-seat of vulcanite or of other comparatively soft materials.



Heretofore in valves of this character the packing has been made in the form of a disk, and has been secured to the valve-head, or in a recess in the valve-head, by a stud which passes through a hole in the disk and a nut which

screws upon the end of the stud and laps upon the outer surface of the disk.

In use the disk is subjected to pressure and to other influences which cause its side edges to adhere to the walls of the recess, and, consequently, upon the removal of the holding-nut the packing cannot readily be removed from its holding-recess. To overcome this difficulty the present arrangement is brought forth of connecting the disk or ring with the holding-nut, so that upon unscrewing it to remove it from the stud the ring or disk of packing is loosened or turned in its holding, so as to become disengaged and drop from its holding-cavity upon the removal of the holding-nut from the stud.

Several methods are shown in the sketches of accomplishing this, and their operation is obvious as affording means of removing the old or worn-out packing by its adhering to the nut or by its being split or pulled from its position sufficient to be removed with the fingers.

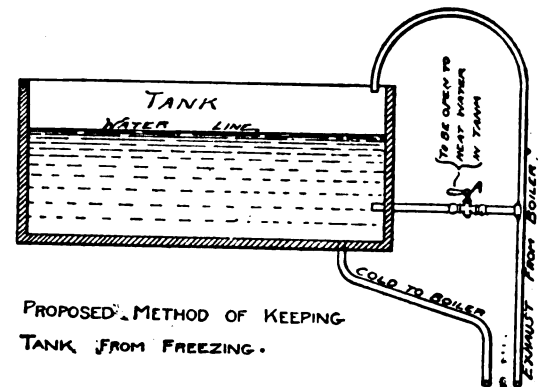
The inventor is Charles Jenkins, of Boston, Mass. The makers are Jenkins Bros., of 71 John Street, New York.

REGISTRATION OF PLUMBERS URGED.

THE British Medical Association, in convention assembled, has passed the following resolution: "That the section of Public Medicine, convinced of its absolute necessity in the interests of the common weal, is strongly of opinion that an organized and efficient system of registration of plumbers and of plumbing work should be put into force in all parts of the Kingdom." This is of course the old story put forward from a new quarter, but there does not seem to have been any provision made for assisting this organized and efficient system of registration which is so emphatically desirable in place of the desultory registration that is now being carried on.

TO PREVENT WATER IN A TANK FROM FREEZING.

A CORRESPONDENT in Boston suggests as a supplement to our reply to Mr. C. Fitzgerald, page 299, issue of August 13, a branch from the exhaust-pipe into a tank, as shown in accompanying sketch, with stop-cock that can



be kept open cold nights. He writes: "If the water-heater is good for anything no trouble will be found in heating the tank-water if the cock A is kept open." It would assist matters if the pipes were covered to prevent radiation.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Knickerbocker Gas-Light Company.	Equitable Gas-Light Company.
September 3...	22.64	22.21	23.64	28.01	28.44	24.10	30.56

E. G. LOVE, Ph.D., Gas Examiner.

SPECIFICATION FOR HEATING-APPARATUS, FORMULA No. 10.

PUBLISHED BY J. J. HOGAN, NEW YORK.

We have received from Mr. John Hogan his Formula No. 10, being blank forms of specifications for heating apparatus. These forms are intended to facilitate the preparation of specifications for heating. They are divided into different sections and are intended to save writing. Blank spaces are provided in each section in which the architect or engineer may make known his detail requirements.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

SWITCH-VALVES WANTED.

NEW YORK, September 7, 1887.

SIR: Who manufactures switch-valves or mixing-dampers for indirect steam-heating? Would like to know sizes and prices.

S. H. & P.

A MAN TO PUT DOWN SCREW-PILES.

NEW YORK, September 9, 1887.

THE address of a good man for putting down iron screw-piles is wanted at this office.

SAN. ENG. & CON. RECORD.

EXAMPLES OF REVETMENT-WALLS AND OF LAND RECLAMATION WANTED.

NEW YORK, September 3, 1887.

SIR: Can you refer me to executed examples of revetment-walls of piles, earth, and stones, cost of same, and published description of methods and construction?

Also examples of land reclamation similar to Potomac Flats, technical description of such works, with cost of same.

W.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

FIRST meeting this fall held September 7, Mr. C. C. Schneider in the chair. Written discussions on "Inspection and Maintenance of Bridges" were presented by W. S. Lincoln, Chief Engineer of the Wabash and St. Louis Railway, and by R. A. Shaler, engineer and contractor, Chicago, and read by the Secretary.

A letter was also read from Fred. C. Weir, a member from Cincinnati, describing 3 chord Howe truss bridges on the railway between St. Petersburg and Moscow, Russia. These bridges were planned in 1840, and work superintended by an American. The timber used in them was planed and burnetized. In 1861 they were inspected by Mr. Harris, an old Massachusetts bridge builder. "Mr. Harris examined every bridge with his little hatchet and reported that not a rotten timber was found."

Nine lithographic copies of the plans of these bridges were exhibited.

The following members were elected:

Calvin Harlow Allen, First Vice-President Buffalo, New York, and Philadelphia Railroad, New York City; Robert Bunker Coleman Bement, now engaged in planning and constructing water-works, St. Paul, Minn.; Peter Franklin Brendlinger, Engineer Pennsylvania Schuylkill Valley Railroad, Pottsville, Pa.; Alva Fisk Brown, General Manager Keystone Bridge Co., Pittsburgh, Pa.; George Devin, member of firm of Pittsburgh Bridge Co.; Roscoe Edwin Farnham, Assistant Chief Engineer of the Chicago and North-western Railway, Chicago, Ill.; Charles Hallett Graham, Assistant Engineer Department Public Parks, New York City; Charles Harlowe, Locating Engineer Chicago, Burlington, and Northern Railroad; David Christian Henny, Assistant to J. A. L. Waddell, M. Am. Soc. C.E., Cleveland, O.; Edward Willard Howe, Assistant Engineer, in charge of Park Construction, Boston, Mass.; William Dunbar Jenkins, Engineer in charge Randolph Bridge over Missouri River for Chicago, Milwaukee, and St. Paul Railway, Kansas City, Mo.; Horace Greeley Johnston, City Engineer of Salina and County Surveyor of Salina Co., Kan.; Alfred Potter Kirtland, Superintendent Western Penna. Div. Pennsylvania Railroad, Blairsville, Pa.; Frederick Nash Owen, Civil and Sanitary Engineer, New York City; Alfred Holden Simpson, engaged in directing work on behalf of the contractors upon the Dry Dock at Newport News, Va.; Otto Frederick Sonne, Principal Assistant Engineer Sibley Bridge, Orrick, Mo.; William Starling, Chief Engineer Mississippi Levee District, Greenville, Miss.; Alfred Thomas Tomlinson, in charge construction Red Hill Tunnel, Denver and Rio Grande Railroad, Badger, Col.; Francis Stuart Williamson, Engineer Wallis Iron-Works, Jersey City, N. J.

For Juniors.—Julius Baier, Assistant Engineer with Robert Moore, St. Louis, Mo.; Gilbert James Bell, Assistant Engineer Sibley Bridge, Orrick, Mo.; Frank Beresford, Principal Assistant Engineer Cincinnati, Hamilton, and Dayton Railroad, Cincinnati, O.; Edwin Mitchell, Assistant Engineer of Sewers, Norfolk, Va.; George Richards Sikes, with United States Construction Co., of Philadelphia, designing cable roads, Philadelphia, Pa.; George Oliver Tenney, in charge of Decatur Land, Improvement, and Furnace Co., Decatur, Ala.; Yoshichika Wada, in Engineer's Office, Sibley Bridge, Orrick, Mo.

THE following additional subscriptions to the new building fund of the society have been received since the last report given on page 183, July 16:

Subscriptions previously received.....	\$5,225	S. Rockwell.....	\$50
T. W. Rowland.....	1,000	John Lawler.....	100
E. B. Dorsey.....	50	C. D. Purdon.....	10
G. Lindenthal.....	50	M. I. Sykes.....	100
J. F. Zorzano.....	100	F. E. Bissel.....	25
C. L. Tompkins.....	50	R. B. Stanton.....	100
C. L. Strobel.....	100	C. B. Brush.....	100
Charles R. Johnson.....	50	James Dun.....	25
J. P. Card.....	100	C. C. Gilman.....	100
R. Forsyth.....	50	S. S. Haight.....	25
P. P. Dickinson, additional subscription, provided other property is purchased.....	150	Onward Bates.....	50
M. M. Tidd.....	50	C. H. Myers.....	25
G. H. Nettleton.....	100	C. B. Nicholson.....	100
John T. Fanning.....	50	T. C. Meyer.....	100
		Wilson Crosby.....	50
		Total, September 6.....	\$8,087

A special committee has been appointed, consisting of Messrs. T. C. Clarke, D. J. Whittemore, and J. M. Wilson, to solicit further subscriptions from members, and others who may feel interested in the society.

AMERICAN INSTITUTE OF ARCHITECTS.

OCTOBER 19 having been selected for the meeting of the American Institute of Architects at Chicago, the following local Committee on Arrangements, appointed by the Chicago Chapter, will co-operate with the Illinois State Association of Architects, and the request is officially made that all papers for the convention reach Secretary A. J. Bloor, Chicago, before October 1: Messrs. W. W. Clay, S. V. Shipman, F. M. Whitehouse, J. L. Silsbee, John Addison, Henry W. Hill and William Holabird.

TO CONFER WITH THE ARCHITECTS.

THE President of the National Association of Builders has appointed Mr. E. E. Scribner, President of the Contractors' and Builders' Board of Trade of St. Paul, the head of a committee to confer with the Western Association of Architects at Chicago, October 19, and formulate a plan for securing uniformity in contracts and specifications. Mr. Scribner's colleagues on the committee are Messrs. G. C. Prussing and P. B. Wright, of Chicago.

NEW YORK ARCHITECTURAL LEAGUE, THIRD ANNUAL EXHIBITION.

THE Architectural League announce that the exhibition which is to be held at the Fifth Avenue Art Galleries, 356 Fifth Avenue, beginning on Monday, December 19, will continue for three weeks. The coming exhibition is to have a different character from any preceding one. It is anticipated that the admission of decorated works, paintings, sculpture, will help to foster the popular interest, while at the same time representing fundamental objects of the league—viz., the promotion of architecture and the allied arts. Intending contributors are requested to send a description of the nature and approximate size of their exhibit as soon as possible. The wall-space of the gallery is 5,000 square feet, with 500 running feet of line. The floor-space is 5,300 square feet. The exhibition will consist of drawings not before publicly exhibited in New York, representing, as far as possible, the present condition of architecture and the allied arts.

The following are admissible: Architectural designs, perspective drawings, sketches in pencil, pen and ink, water colors, charcoal, etc.; elevations, working drawings and photographs of executed work; paintings in oil and water color of architectural subjects; sketches for interior decoration and furniture; designs and cartoons for stained glass; mural decoration; executed work, such as mosaics, stained glass, and decorative stuffs; wrought iron and metal work, sculpture, carving and casts, and models of architectural and decorative work.

The Executive Committee is Frederick Crowninshield, John DuFais, Bruce Price, Charles I. Berg, John Gelatly, John Beverly Robinson, William Convers Hazlett, Arthur B. Turnure, Edward H. Clark, John P. Riley, Frank A. Wright. Circular giving detailed information obtainable of Charles I. Berg, Secretary, 152 Third Avenue, New York.

THE Municipal Council of Paris has voted 321,260 francs to increase the security of the public in two of the municipal theatres—the Châtelet and the Gaîté. It is proposed to open and change doors of exit, to build interior staircases, supply iron curtains and fire-escapes.

WATER-WORKS STRUCK BY LIGHTNING.

DURING a thunder-storm on August 24 the water-tower of the water-works at Mount Vernon, N. Y., was struck by lightning and damaged, a hole being made in the side which allowed a considerable quantity of water to escape with great force. The supply was checked until the necessary repairs can be made.

MR. G. J. SPECHT, Civil Engineer, of San Francisco, writes, in the last quarterly number of the *Zeitung des Oesterreichischen Ingenieur und Architekten-Vereins*, an exhaustive article on the street cable railways of San Francisco, accompanied by numerous sketches and tables showing cost of maintenance, passengers carried, and relative cost as compared with horse railroads. The writer alludes to the cable roads of Chicago and Kansas City, but omits any mention of the Third Avenue Cable Road on One Hundred and Twenty-fifth Street and Manhattan Avenue in New York City.

A PRINTED statement from the Bureau of Statistics of the Treasury Department shows that during the seven months ending July 31 there were exported from Boston, New York, Philadelphia, and Baltimore, 35,984,667 gallons of crude mineral oil; 6,437,586 gallons of naphtha; 260,703,798 gallons of illuminating oil; 10,786,900 gallons of lubricating and paraffine oil, and 2,599,422 gallons of residuum. The total for this period was 316,512,373 gallons, against 329,515,224 gallons for the corresponding period of 1886.

PERSONAL.

MR. CHARLES E. EMERY has resigned his position of Manager and Engineer of the New York Steam Company. He proposes to devote himself to a consulting practice. He is now Consulting Engineer of the New York Steam Company, the Edison Electric-Light Company, the New York and Brooklyn Bridge, United States Revenue Marine, Pneumatic Dynamite Gun Company. His services can also be secured as an expert in certain classes of patent-cases.

COMMANDER GEORGE W. SUMNER, U. S. N., has been ordered to duty at the Naval War College. Lieutenant W. C. Cowles has been detached from duty as inspector of steel at Pittsburg, Pa., and ordered to ordnance duty at Washington Navy Yard. Assistant Engineer Emil Sheiss has been detached from the "Ranger," and ordered to duty in the Bureau of Steam Engineering. Commander Charles D. Sigsbee is detached as a member of the Examining and Retiring Boards, and ordered to duty at the Naval Academy.

THE survivors of the Engineer Brigade had a reunion at Canandaigua, N. Y., August 25. The following officers were elected for the ensuing year: President, John F. Davidson, of Elmira; Secretary, Major E. O. Beers, of Elmira; Treasurer, Sam B. Williams, of Rochester. A resolution was passed requesting Colonel Fowle to prosecute his preparation of a history of the engineers, and assuring him of the encouragement and support of the members of the association. Speeches were made by F. H. Hamlin, Captain John T. Davidson, of Elmira, Hon. John Raines, and the Hon. E. M. Morse.

ALEXANDER STUART, architect of Balmoral Castle and other buildings in Scotland, died recently at Peterhead. He was a brother of Mr. James Stuart, architect, of St. Louis, Mo.

MR. R. E. OSGOOD, now of the firm of Burkett & Osgood, architects, of San Diego, Cal., will continue the business alone.

ALVAN CLARK, one of the most celebrated makers of telescope-lenses in the world, died at Cambridge, Mass., August 19, aged eighty-three years. Mr. Clark, by profession a portrait painter, taking up the study of astronomy and the art of telescope-making as a pastime, developed his skill until his instruments made him known the world over.

ARCHITECTURAL COMPETITIONS.

MILWAUKEE.—The plans of H. C. Koch for a \$48,000 "full graded" school building have been adopted by the Building Committee.

TRADE CATALOGUE.

THE Gurney Hot-Water Heater Co., of 237 Franklin Square, Boston, Mass., have issued a pamphlet of instructions for erecting low-temperature hot-water apparatus.

MESSRS. THOMAS KELLY & BROS., of 75 Jackson Street, Chicago, Ill., have issued their 1887 catalogue and price list, illustrating the Kelly Self-Acting Water-Closet.

PROPOSALS.

TOO LATE FOR CLASSIFICATION.

PUMPING machinery for McKeesport, Pa. Until September 22. Capacity 5,000,000 gallons daily through 1,400 feet of force main, to a height of 305 feet. Endorse "Pumping-Engine," and address Joseph Ecoff, Superintendent of Water-Works.

WATER-PIPE.—The Water Commissioners, of Saratoga, N. Y., want proposals until September 4 for laying 4-inch iron water-pipe. Address Samuel F. Cobey, Clerk.

GRADING for two tracks, New York Division, P. R. R. Until September 15. Address W. H. Brown, Chief Engineer, 233 South Fourth Street, Philadelphia.

WATER-WORKS.—Proposals will be received until September 13 for pumping machinery, subiding reservoir, engine-house, and pipe-laying for the Holmesburg, Pa., Water-Works. Specifications may be obtained and drawings seen at Holmesburg. Address A. C. Shallcross, Secretary Holmesburg Water Company, Holmesburg, Pa.

BUILDING FOR DEAF MUTES.—Proposals for the new building of the Northern New York Institution for Deaf Mutes at Malone will be received up to September 20. Plans and specifications can be examined at the office of Hon. John I. Gilbert, President, Malone, after September 8, inst.

MILWAUKEE.—The Milwaukee Cement Co. have leased the Orton property on the Milwaukee River for \$2,000 per annum, and will add it to their already immense plant and will turn out 1,000,000 barrels of cement a year. The works will be doubled, and \$50,000 expended in new buildings, machinery and tramways. The Chicago, Milwaukee and St. Paul R. R. Co. and the Chicago and Northwestern R. R. Co. will extend their tracks to the plant and be completed for the spring trade.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



For works for which proposals are requested see also the "Proposal Column," pages 393-397-399-400.

WATER, SEWERAGE, ETC.

ACKRON, CAL.—will expend \$45,000 for water-works. Address the Town Board.

CENTREVILLE, IOWA.—Our correspondent writes: "No steps have been taken of for immediately putting in water-works. We are sinking an artesian well, with the ultimate intention of putting in water-works."

MORRISON, ILL.—Our correspondent writes: "We have and have had for the last five years as good water-works as any city four times our size in Illinois. None wanted."

ANOKA, MINN.—The Ram River lumbermen will build a dam at the foot of Mil's Lake. F. L. Pinney, of the Washburn Mill Co., will build it.

PAWNEE CITY, NEB.—On Monday the city will vote on introducing water-works. It is expected the proposition will be carried by a large majority.

HEKIMER, N. Y.—The election September 1 went strongly in favor of building water-works.

LOS ANGELES, CAL.—Incorporated is the Alessandro Land and Water Company; Charles French, J. E. Packard and others.

BAYFIELD, WIS.—Address Professor W. F. Dennison about water-works here.

HAYWARD, WIS.—will spend \$12,000 in putting in water-works.

SAN DIEGO, CAL.—Colonel George E. Waring, now in San Diego, estimates the cost of the new sewerage at about \$300,000. A proposal relating to this work will be found elsewhere.

CENTRAL CITY, NEB.—is agitating water-works. Contractors should put in propositions at once.

NORTH PLATTE, NEB.—is to have a new system of water-works, and a company formed for that purpose has filed articles of incorporation with the Secretary of State. The company's capital stock is \$125,000.

OID, MICH.—This city at its recent election voted in favor of water-works.

BURNET, TEX.—Our correspondent writes: "Our City Council on a petition, signed by very near all of the property holders of our city, have concluded to levy a tax for the purpose of sinking one or more artesian wells (which is our only chance for obtaining a supply of water) in the city, and, for that purpose, have appointed a committee to make contract with responsible parties for sinking said wells. The committee made a contract with one Mr. Taylor to sink and furnish a 6-inch well for \$2,500. Mr. T.'s partners not agreeing with him, he failed to execute bond for the thorough and faithful performance of contract, and the committee has been instructed to correspond with artesian well men and solicit propositions, etc."

TERRELL, TEX.—Our correspondent writes: "This city has already established a good system of water-works. We are now only increasing the supply of water by digging another large well."

NICKERSON, KAN.—Our correspondent writes: "Contract will be let as soon as bonds are sold for water-works. Bonds will be sold September 12, \$30,000, to run 30 years at 6 per cent. We will put in two 750,000-gallon pumps and about four miles of pipe."

EASTPORT, ME.—The selectmen have been authorized to enter into a contract with the Eastport Water Co., to supply the town with water from Boyden's Lake, the town to pay \$4,000 per year. The works shall be completed from Boyden's Lake on or before September 1, 1888.

MCKENZIE, TENN.—will obtain a supply of water from an artesian well.

PROVIDENCE, R. I.—City Council has received a report from Samuel M. Gray, City Engineer, on sewerage, and has ordered the preliminary work done at once.

SACRAMENTO, CAL.—Thomas Findlay, Superintendent of the California Water Company, is making arrangements to pipe water across the American River from the El Dorado County side to Newcastle, in Placer. It will take several miles of pipe and will furnish an immense volume of clear, pure mountain water. The citizens of Roseville are negotiating with Mr. Findlay to pipe the water to that place, where, in addition to its use for irrigation, it will be used for domestic purposes.

KEOKUK, IOWA.—The American Water-Works and Investment Company, of Pittsburg has bought a controlling interest in the Keokuk Water-Works.

CANNON FALLS, MINN.—The Cannon Falls Village Council has definitely decided to put in water-works on the top of Lime Kila Bluff, the water to be carried into the village by 1,500 feet of mains.

BISMARCK, DAK.—The water-works contractors have completed four miles of ditching and laid 7,000 feet of pipe, and built one reservoir.

CHEROKEE, IOWA.—Our correspondent writes: "The Council has not taken any action in regard to water-works."

DULUTH, MINN.—Address C. H. McMaster, Secretary of the Board of Trade, about the proposed sewerage system. It is proposed to introduce small pipe sewers.

MILWAUKEE.—Water-mains will be laid in Twenty-eighth Street, from Grand Avenue to Wells Street, in Twentieth Street from Wells to Cedar Streets, in Commerce Street, in Mound Street from South Bay Street to Lincoln Avenue, Harmony Street from Balfum Street 300 feet west of Buffum Street. Water-pipe will be laid in Muniego Avenue and North Canal Street, from Park Street to Clarendon, and fire hydrants put in as recommended by James Foley, Chief of Fire Department.

CHATTANOOGA, TENN.—We have already noticed that the city would vote on the question of bonding for sewers. Our correspondent writes, under date of September 2, that the proposition was carried by a heavy majority. The amount voted was \$50,000, and work will be begun as soon as arrangements can be made. A. C. Casey is City Engineer.

EAST WYOMOUTH, MASS.—Town meeting August 31 voted to raise water bonds for \$50,000 to be applied to increasing the water-supply.

SAVANNAH, GEO.—Well men should address at once the City Engineer, for the city will sink several new wells at the water-works.

ROCHESTER, MINN.—The Water Committee tested the new water-works September 1, and found them satisfactory.

KENT, O.—The Kent Water-Works have been accepted by the Water Committee.

ATLANTA, GEO.—The newly completed Clear Water Reservoir burst September 1, and involves a repair of \$9,000 to \$10,000.

ORLAND, CAL.—Address N. K. Specht about a great irrigation scheme here.

SENECA FALLS, N. Y.—The Water-Works Company has decided to build the necessary works to take water from Cayuga Lake.

BAR HARBOR, ME.—The Eden Water Company, Charles T. How, of Boston, President, will begin work at once on the water-supply for this place and neighboring points.

HUDSON, WIS.—will obtain a supply of water from wells.

WASHINGTON, PA.—See our Proposal Columns for water-works here.

CARLINVILLE, ILL.—Contractors have been here looking over sources of water, etc., with a view to putting in bids for constructing works. The city has already voted to have them. Address the City Engineer.

VALLEY FALLS, KAN.—The construction of water-works will be begun soon. Address the City Clerk.

LANCASTER, PA.—The Committee on Sewerage and Water-Supply are ready to receive bids under the plans of J. J. R. Croes, C. E., of New York City, for change in water-supply. Attend to this.

MANKATO, MINN.—It is reported bids for constructing the water-tank or reservoir will be readvertised, as those recently opened are too high.

PORTLAND, CONN.—proposes to build water-works soon. Address the Town Clerk.

SAN FRANCISCO, CAL.—Capitalists have formed a company to tap Lake Tahoe for power and irrigation.

MARINETTE, WIS.—The Marinette Council has adopted an ordinance giving exclusive franchise to the American Water-Works and Guarantee Company to construct water-works in that city.

COSHOCOTON, O.—will have water-works. Address the City Engineer.

MARION, IOWA.—Address the City Engineer in regard to the laying of additional water-mains at a cost of \$25,000.

BRIDGEPORT, CONN.—The Common Council has taken steps to ascertain the price at which the Bridgeport Hydraulic Company and the Citizens' Water Company will sell their works to the city.

AUGUSTA, GEO.—J. H. Shedd, C. E., of Providence, R. I., has been engaged by the Augusta Water Company to examine the reservoir and make plans and estimates for its completion.

TUCSON, ARIZ.—On September 12, C. M. Strauss, of the Board of Regents of the Territory of Arizona, will receive bids for sinking a well from 100 to 500 feet.

WAUWATOSA, WIS.—The water-works were tested and accepted Thursday, September 8.

DUBUQUE, IOWA.—City Council has extended the time for letting contracts for work on the sewerage system to September 15.

STROMSBURG, NEB.—An election has been called to vote on raising \$12,000 for water-works. Address the City Clerk.

SYRACUSE, N. Y.—A 24-inch main sewer will be advertised for in Gifford Street.

SAN DIEGO, CAL.—The Fallbrook Water and Power Company has been chartered, with a capital of \$300,000, to build dams, reservoirs, conduits, etc., to bring water from the San Margarita River. J. D. Hanbury and T. J. Wrampelmeier are directors.

SUFFOLK, VA.—Water-works are to be constructed. Address R. R. Prentiss.

FRAMINGHAM, MASS.—Our correspondent writes: "At the town meeting held the 6th of September, the town voted to dismiss the article in regard to the purchase of the water-works."

HEKIMER, N. Y.—We have previously noticed the election for water-works. Now our correspondent writes that the town will be ready to receive bids in two weeks.

RALEIGH, N. C.—J. L. Ludlow, of Winston, has the contract for building sewers here.

KENDALLVILLE, IND.—is asking for bids to construct water-works.

MILTON, CAN.—will construct water-works at a cost of \$20,000.

BRISTOL, TENN.—wants water-works. W. G. McDowell has made a proposition.

WINCHESTER, KY.—Mr. Garner will sink wells here for gas and water.

BOWLING GREEN, O.—Ferris & Holliday, of Jersey City, has submitted a proposition to build water-works here.

VANDALIA, ILL.—is receiving propositions for erecting water-works.

GALVESTON, TEX.—We have noted that extensive additions and improvements will be made in the water-supply. Commissioners are J. M. Brown, N. W. Coney, John Colter, Albert Weiss, W. F. Beer.

SPRAGUE, WASH. T.—Incorporated is the Sprague Water Company. Incorporators, George S. Brooke, D. K. McPherson, John J. Burns, and others.

WATER COMPANIES.—Incorporated are the Pasadena, Cal., Rincon Land and Water Co.; Ezra Dane, I. M. Hill, Edson Turner, George Bell, and George W. Dunmore, directors.

The San Felipe Land and Water Co., of Los Angeles, Cal.; Presley C. Baker, A. D. Childers, directors. The Montecito-Santa Barbara Water Co., of Santa Barbara, Cal.; W. S. Meach, Sacramento; E. H. Howard, San Francisco; J. M. Hunter and E. H. Peacock, Santa Barbara; and John W. Ellis, Los Angeles, directors.

The Nipomo Water Co., Nipomo, Cal.; I. B. Thayer, chairman; S. A. Dana, secretary, and P. Fry, treasurer; San Diego Water and Land Co.

POTTSTOWN, PA.—Our correspondent writes: "At this time the water company—a private corporation—does not intend to make any important changes in the water-works further than to lay more water-pipes (in streets not yet supplied, and in new streets laid out in our fast-growing town). In the near future, however, the basin must be enlarged or a new one made; the inlet-pipe must be taken out and one of greater capacity put in, or, which is most probable, the present source of supply and the basin discontinued, and a new one put in at a place two miles farther up the river. A new engine, pump, pipes, basins, etc., will be the result—equal to a new water-works, except the supply-pipes in the streets."

REDDING, CAL.—The Shasta Water Company, of Redding, has been incorporated; capital stock, \$300,000. Warren B. Ewer, San Francisco, and others incorporators.

RIVERSIDE, CAL.—J. S. Castleman, John Hall, and others have incorporated Hall's Addition Water Company; capital, \$40,000.

NORFOLK, NEB.—The recent city election authorizes the issuing of bonds to grade Main Street, put in a system of sewerage, erect a city hall, and purchase the necessary apparatus for a fire department.

HOLMESBURG, PA.—Proposals for water-works will be received until September 12. See our Proposal Columns.

SARATOGA, N. Y.—The Water Commissioners want bids for 4-inch water-pipe.

NORTH PLATTE, NEB.—A water company has been incorporated.

MILWAUKEE.—Second bids opened September 5 for repairing crib at pumping works: William A. Starke, \$2,024, and W. T. Costigan, \$1,975, are yet beyond appropriation available.

LANSINGBURG, N. Y.—Engineer Franklin is making estimate of cost and capacity of proposed new reservoir.

MANCHESTER, VA.—Address John S. Taylor about water-works to be built here.

FORT WORTH, TEX.—Incorporated is the Dallas City Water Company.

CARSON, IOWA, is asking for propositions to build water-works, costing \$100,000.

RIVERTON, NEB., has voted to issue bonds for funds to build water-works.

PHENIX, N. Y.—This town has voted by a large majority to have water-works.

SANFORD, N. Y.—A company is being formed to construct water-works. A pumping-plant will be wanted.

WALTHAM, MASS.—The Aldermen have advanced orders calling for \$19,000 of sewers.

HOLLIDAYSBURG, PA.—It is proposed to replace the wooden water-mains with cast-iron pipe.

St. JOSEPH, MO.—A sewer-system to cost \$45,000 to \$60,000, for Blacksnake Creek, will be built by the Diagonal Railroad Company. The City Engineer of St. Joseph has prepared the plans and specifications. Address him at once. Another sewer will be built by the Kansas City, St. Joseph, and Council Bluffs Railroad.

GAS AND ELECTRIC-LIGHTING.

RED WING, MINN.—The Globe Electric-Light and Power Company has been awarded the contract for lighting the town.

JAMESTOWN, DAK.—L. B. Durstine, of this city, has been awarded electric-light franchise.

The Shamokin Arc-Light Co., of Shamokin, has been incorporated; capital stock, \$10,000. A. Robertson, Pottsville; Holden Chester, C. C. Leader, George O. Moitz, and W. C. Smith, Shamokin, incorporators.

OWENSBORO, KY.—The Owensboro Mineral Company has recently begun boring for gas near the city limits. The well will be sunk twenty-five hundred feet, or until gas is reached. Colonel J. D. Powers, of this city, is President of the company.

COUNCIL BLUFFS, IOWA.—The Economic Light Company, recently organized to build gas works in the towns of the State, has begun work here. A plant will be erected and gas furnished at \$1.95 per 1,000 cubic feet.

MILLBURY, MASS.—The town hall will have electric-lights. The wiring is completed.

VICTORIA, TEX.—Address W. J. McNamara about constructing a plant for the refrigerating company.

PITTSBURG, PA.—The Kendrick Light and Heating Company has applied for a franchise. George B. Hill, F. Rohm, and others are interested.

The Duquesne Natural-Gas Company also wants a charter and franchise. W. H. DeWald, H. M. Bowman, and others.

CHATTANOOGA, TENN.—The Chattanooga Oil and Gas Company is sinking wells. Contracts for derricks let.

LAWRENCE, KAN.—Large additions are being made to the works of the Lawrence Gas Company under direction of E. L. Hopper, Gas Engineer, of Philadelphia.

MERIDEN, CONN.—The Meriden Gas Company and Meriden Electric-Light Company have consolidated with a capital of \$250,000, and George R. Curtis of the Gas Company was chosen President.

DUNDER, MICH.—A company with \$300,000 capital has been formed to bore for oil and gas.

FLUSHING, L. I.—The franchise for lighting the streets with electricity was sold September 6 to a representative of James H. Hurst, of New York. Steps will be taken at once to build the plant.

HALIFAX, N. S.—J. W. Chandler & Co. have nearly completed negotiations with the city by which the former will erect in ninety days an electric-lighting plant. It is said eleven firms are trying to secure the contract from Chandler & Co. to build and equip the station and plant.

AUGUSTA, GEO.—Two electric-light companies, one the Edison, the other the Thomson-Houston, are putting up wires to light the streets.

CENTRAL CITY, NEB.—Electric-light plant prospectors should address propositions to City Council, which is now considering the question of lighting the streets by electricity.

CHICAGO.—Incorporated is the People's Gas-Saving Association; F. S. Amick and others.

WELLSVILLE, O.—The Citizens' Electric Light and Power Company has been organized here with a capital stock of \$50,000.

PLATTSBURGH, NEB.—An electric-light plant is to be erected here.

KENNEBEC, ME.—The Kennebec Light and Heat Company has made arrangements to erect an electric-light plant.

SHEFFIELD, ALA., has let a contract for lighting the streets with electric-lights.

GRAHAM, N. C.—Address L. B. Holt with propositions for constructing an electric-light plant for a cotton mill.

SUMTER, S. C.—Address D. J. Winn, Sumter Cotton Mills, about an electric-light plant for the mills.

CARROLLTON, MO.—An electric-light plant is wanted here.

MOUNT PLEASANT, MICH.—A company has been formed here to sink gas-wells and develop gas-plants.

SIOUX CITY, IOWA.—Pierce Bros., of Hudson, Wis., offer to put in a \$30,000 electric-light plant if the city will grant a franchise, with permission to erect poles.

PASADENA, CAL., wants electric-lights for the streets.

JAMESTOWN, DAK.—The city has contracted with Lee B. Durstine to furnish electric-lamps for street-lighting. The Edison Company will furnish the plant.

ELIZABETH, N. J.—The Westinghouse Electric-Light and Power Company has petitioned City Council for a franchise to permit them to erect wires for street-lighting.

MARYSVILLE, O.—J. C. Guthrie, Village Clerk, is receiving bids for constructing gas-works here.

WESTCHESTER, PA.—Contract for lighting Westchester State Normal School was given to gas company at the bid \$187.50 less than the Edison Electric-Light Company, of Westchester.

ELECTRIC-LIGHT COMPANIES.—We notice the following: The Edison Electric-Light Co., of Salina, Cal., incorporated; William W. Roller, Robert M. Ridgway and others, incorporators.

The Sprague Electric-Light Co., of Sprague, Wash. T., incorporated; George S. Brooke, D. K. McPherson, John J. Burns, incorporators.

The Iron Mountain Electric-Light Co., of Iron Mountain, Mich., incorporated; Arthur D. Moore and others, incorporators.

SUMTER, S. C.—An electric-light plant will be established here.

TRENTON, N. J.—The contract for a police patrol system has been awarded to Pierce & Jones.

BATESVILLE, ARK.—The Davis Telephone Co. will erect seven miles of wire from here to Jamestown.

STEAM-HEATING, BUILDINGS, ETC.

ST. PAUL, MINN.—The Holland & Thompson Manufacturing Co., of St. Paul, have obtained a contract for heating-apparatus for the Spalding House, at \$18,000.

RALEIGH, N. C.—The time of opening bids for heating our public buildings has been extended to September 15.

MONTGOMERY, ALA.—At a meeting here September 5 the trustees of the A. and M. College at Auburn awarded the contract for building the laboratory to Floyd & Stephens, of Opelika, at \$11,000; Bruce & Morgan, of Atlanta, are the architects.

PEKIN, ILL., is organizing a steam-heating company.

SAN DIEGO, CAL.—The Elsinore Improvement Company is the name of a new land and town company incorporated to subdivide and lay out town sites and to do a general real estate business. F. H. Heald, G. C. S. Gilbert, H. L. Conard, S. M. Cambern, and Gilbert Dexter will act as directors for the first year.

MILWAUKEE, WIS.—The Board of Public Works wants heating-apparatus for schools. Write them at once.

MINNEAPOLIS.—Building Inspector Barnum has submitted his report for the quarter ending August 31, the following being a summary:

No.	Kind.	Valuation.
53	miscellaneous.....	\$396,532
16	brick stores.....	378,600
6	brick veneered stores.....	16,000
18	frame stores.....	25,560
17	brick dwellings.....	134,000
16	brick veneered dwellings.....	110,000
290	2-story frame dwellings.....	598,600
60	1½-story frame dwellings.....	36,675
40	1-story frame dwellings.....	8,884
784	additions and repairs.....	140,483
181	barns.....	44,385

The total number of permits issued during the three months was 1,481, and the estimated value of the different classes of structures, \$2,095,078.

ASHLAND, WIS.—A \$10,000 plant for the Lake Superior Soap Co. will be put in.

BRIDGES.

WACO, TEX.—It is reported that every bridge in Hill County has been washed away by freshets. A large outlay will be required to rebuild. Address the County Clerk of Hill County.

BUFFALO, N. Y.—State Superintendent Shanahan, of Albany, is advertising for bids for building a bridge over the Erie Canal at Hudson and Austin Streets.

VINTON, CAN.—James Morrison, of Ottawa, has the contract for building the masonry of a bridge over the Coulonge River, for the Pontiac and Pacific Junction Railroad.

CARLETON PLACE, CAN., has voted \$10,000 for an iron bridge over the river.

PITTSBURG, PA.—The Pittsburgh Dispatch states that the Pandanville Road will build a \$1,500,000 bridge over the Ohio River at Brunot's Island. Chief Engineer Becker is making plans.

CHATTANOOGA, TENN.—The Iron Bridge Company, of Decatur, Ala., has the contract for a bridge over the Tennessee River here, at about \$200,000.

KANSAS CITY, MO.—The Belt Line Railroad Company will build a bridge here. Address John Diebrick, Twenty-third Street and Broadway.

AMERICUS, GEO.—Address bids for building an iron draw bridge, 180 feet long, to B. H. Hardaway, Chief Engineer of the Americus, Preston, and Lumpkin Railroad, at Americus, Geo.

WILMINGTON, DEL.—Address C. E. Pugh, 233 South Fourth Street, Philadelphia, about a bridge which the Philadelphia, Wilmington and Baltimore Railroad Company will build.

SIDNEY, NEB.—It is proposed to build a \$45,000 bridge over the North Platte River.

IONIA, MICH.—Address J. J. McVean about a railroad bridge to be built for the Detroit, Lansing and Northern Railroad.

HINDOSTAN, IND.—The County Commissioners will build a \$40,000 bridge over White River.

MUSCATINE, IOWA.—The contract for stone-work on a bridge over Pappoose Creek has been given to Edwards & Walsh.

ELIZABETH, PA.—It is proposed to build a \$100,000 bridge over the Monongahela River.

SIBLEY, MO.—The Atchison, Topeka and Santa Fe Railroad will build a steel bridge here to cost \$1,250,000. Address J. F. Goddard, Topeka, Kan., General Manager.

FOND DU LAC, WIS.—Proposals for two iron bridges are wanted.

STREET WORK AND PAVING.

SAN ANTONIO, TEX., is negotiating \$150,000 of bonds to make local improvements.

OAKLAND, CAL.—Twenty-third Avenue will be improved with grading, curbing, and paving, and crosswalks; also Brush Street. Address A. C. Henry, Clerk of City Council.

BOSTON.—Notice of the following street-work is given: Widening Tremont Street, at Roxbury; opening of Calumet Street, at Roxbury; opening of Sachem Street, at Roxbury. Address the Board of Street Commissioners.

WHEELING, W. VA.—There is a movement here to raise funds to convert Camp Carlisle into a park. Address the editor of the *Intelligencer*.

ROCKVILLE, CONN.—A carriage road will be built around Snips Lake. Address G. W. West.

CHAMBERSBURG, N. J.—Change of grade of Wolverton and Clark Avenues, with other improvements, is advertised.

TRENTON, N. J.—Lamberton Street will be improved with change of grade.

FLUSHING, L. I.—Flagging for Washington Street sidewalks is ordered.

AUGUSTA, GEO.—Alderman Dempsey has a plan for building levees, 30 feet wide on top, all around the city.

WILKESBARRE, PA.—Paving is ordered on Chestnut and Hazle Street, and sewers and crossings in various streets. Address the City Engineer.

LAKEWOOD, ILL.—The engineer will advertise for bids for paving Diversey and Frederick Streets and Wright Avenue.

BOSTON.—Union, Dorchester, and Baxter Streets, South Boston, will be improved.

SYRACUSE, N. Y.—Contracts for street work have been awarded by the Board of Aldermen as follows: For furnishing 1,000 cords of hard limestone spalls at the crusher, to A. E. Alvord, at \$2.44; for delivering 100 tons of slag in each ward, to Frank Matty at these figures: First, Second, Fourth, Fifth, Sixth, and Eighth Ward at 50c.; Third at 38½c.; Seventh and Ninth at 60c.; Tenth at 3¼c.; Eleventh at 70c.; for paving the gutters of Harrison Street to Anthony McNamara at \$373.50.

JANESVILLE, WIS.—H. H. Macloon, J. R. Bleasdale, O. C. Ford, are a Council Committee on paving Milwaukee Street.

WEST STRATFORD, CONN.—Street-work and sewers (Grand Street) are advertised for. Address the Town Clerk.

PHILADELPHIA.—Plans for the widening of Chestnut Street have been prepared by the Bureau of Public Works.

GALEN AND SAVANNAH, N. Y.—A highway will be built from Savannah to Galen. Plans by Vandenberg & Saxton, of Clyde. Address bids to the Commissioners of Highways, until September 24, to the care of Vandenberg & Saxton.

RAILROADS, CANALS, ETC.

ST. CLOUD, MINN.—The general car shop and stock yards of the entire Manitoba Railroad system will be located here. About \$1,000,000 will be expended, work to begin at once. The St. Cloud Motor Line has been incorporated to build a street railway. H. C. Waite, John Cooper, and D. B. Searle are interested.

MILWAUKEE.—The Wolf & Davidson Steamship Company, of Milwaukee, was incorporated September 2. W. H. Wolf, T. Davidson, and F. L. Vance are the incorporators, with a capital stock of \$80,000. To build and operate steamboats and vessels is the object.

BILLINGS, DAK.—Dennis Ryan, of St. Paul, has been awarded the contract for building the Rocky Fork and Cook City Railroad, a new road.

MILWAUKEE.—The Milwaukee City Railway are to extend their tracks across the river.

MILWAUKEE.—The Milwaukee and Whitefish Bay Railroad Company will build a new road to run dummies.

ST. PAUL, MINN.—The St. Paul and Minneapolis Rapid Transit Co. has been incorporated for the construction of an elevated or surface railroad between the two cities, with a capital stock of \$2,000,000.

SIoux CITY, IOWA.—Address L. F. Wakefield, engineer, about the extension of the Sioux City and North-eastern Railroad.

NEW BRUNSWICK, N. J.—A company, composed of Christopher Meyer, Henry S. Little, Senator D. C. Chase, and Congressman John Kean, Jr., has been formed to build a new branch railroad twelve miles long between this city and South Amboy. The road is to cost \$100,000.

RAILROAD.—The North Dakota and Pacific Railroad Company has filed articles of incorporation with the Secretary of State, to build a railroad from some point in Norman County to some point in Dakota. The principal office is at St. Paul, Minn. The highest amount of indebtedness shall be \$15,000 for each completed mile of track. The incorporators are Charles G. Lawrence, Harris Richardson, and others, of St. Paul.

LARAMIE, WYO. TER.—A company has been organized here, with a capital of \$100,000, to build a street railway.

SPRINGFIELD, ILL.—Incorporated is the Cairo and Northwestern Railroad Company of Illinois. The principal office is to be located at Cairo and the capital stock is \$1,000,000. It is intended to construct the road from Cairo to East Cape Girardeau. The incorporators and first board of directors are Charles O. Patier, Fredolin Bros, Peter Neff, Edward A. Buder, and Henry Wells, all of Cairo.

LYNN, MASS.—The Lynn and Boston Railroad Company will lay new track on its grounds in this city.

SPRINGFIELD, ILL.—Incorporated are the Mississippi River and Ocean Navigation Company, at Alton, capital stock, \$5,000,000; to construct and operate ocean and river steamships; incorporators, Andrew H. Lucas, John F. Cahill, and William Lucas. The Underhill Mining Company, at Belleville, capital stock, \$2,000,000; to conduct a general mining business; incorporators, W. N. Homer, D. J. Canly, and F. M. Priester. The Rubicon Mining Company, at Belleville, capital stock, \$2,000,000; to carry on a general business of mining gold and silver; incorporators, G. A. Koerner, William Priester, and W. N. Homer.

STOCKTON, CAL.—A scheme is raised to cut a ship canal from Stockton to deep sea water. The earth removed will be used to improve adjoining lands. Address the City Engineer for further information.

ASHEVILLE, N. C.—The Asheville and Tennessee Railroad is incorporated to build from Asheville to the State line; President, S. R. Kepler; Vice-President, Matt Atkinson.

DENVER, COL.—A franchise has been granted to George W. Bowman and others, to build a cable railroad on Golden Avenue and other streets.

OAKLAND, CAL.—The Oakland, Alameda and Laundry Farm Railway Company filed articles of incorporation recently. The directors are, J. H. Woodward, F. J. Moffit, H. T. Smith, E. G. Matthews, and J. H. Costigan.

LORAIN, O.—The Lorain Street Railroad Company, of Lorain, has been organized with a capital stock of \$5,000.

CONYERS, GEO.—A street railroad will be built. Address F. M. Ridley, of the company.

PROVIDENCE, R. I.—The City Council has authorized the Mayor to appoint a committee of three engineers to consider improved facilities for railroad terminals.

MINNEAPOLIS.—The Minnesota and Northwestern Railway Company will build a round-house and machine shops in South-west Minneapolis to cost \$135,000.

SAVANNAH, GEO.—The construction company of the Atlanta and Hawkinsville had agreed to take the road to Barnesville in consideration of \$50,000 and the right of way, if the directors would approve. The directors refused to consent.

PORT TOWNSEND, WASH. T.—Articles of incorporation were received from California with several prominent railroad capitalists' signatures affixed August 26 for the purpose of incorporating, constructing and maintaining a railroad from Port Townsend to the Columbia River. The capital stock is \$3,000,000, in 30,000 shares.

LOS ANGELES, CAL.—Articles of incorporation were filed yesterday by the Sierra Madre Improvement Co. It proposes to construct and operate a street railway from the Santa Anita station on the California Southern Railroad, a distance of five miles. The directors are N. C. Carter, Emile Deutch, A. D. Hawks, (Secretary), A. D. Trussell, (Treasurer), and L. Richardson.

KNOXVILLE, TENN.—An English syndicate with a paid-up capital of \$1,000,000 will commence at once the erection of two blast-furnaces here, of 200 tons capacity each. A member of the syndicate states that 1,600 hands will be needed. Two new railroads will be let to contractors within thirty days, and the third within sixty. Two other roads are pointing this way, and officials say are sure to come.

The Sevier County Court has agreed to submit a proposition to a vote to give \$75,000 to a road from Augusta, Geo., by way of Greenville, S. C., to this place. Private subscriptions will give the road \$100,000, which is about subscribed.

LOS ANGELES, CAL.—The Brooklyn Heights Railway Company was incorporated August 11. It proposes to operate street railways, beginning at the Plaza and running to the eastern limits of the city.

LOS ANGELES, CAL.—Articles of incorporation were filed August 11 by the Depot Railway Company. The object is to construct street railways in this city. The directors are: James M. Davis, M. L. Wicks, J. F. Davies, W. H. Davies, and J. Bernard. Capital stock, \$100,000; amount subscribed, \$77,000.

DENVER, COL.—Address George Wirt Bowman about the proposed cable street railroad, which he is a promoter of.

KANSAS CITY.—The Kansas City and Sabine Pass Railway Company filed articles of incorporation August 17, and received a charter for the State of Missouri with a capital of \$2,500,000. Colonel Harrison M. James, of New York, is President, and Fred M. Day, of Brooklyn, Treasurer. The object is to build an air line from Kansas City to Sabine Pass, a distance of 700 miles.

RAILROAD.—Incorporated is the Oakland, Cal., Alameda and Laundry Farm Railroad Company. The line will be a broad gauge, running from Laundry Farm to Seminary Park Station on the line of the Southern Pacific.

PITTSBURG, PA.—A charter was issued August 23 to the Pittsburgh and Bellevue Passenger Railway Company; capital, \$15,000. The length of the road is to be four miles.

DUBUQUE, IOWA.—The Dubuque, Kansas City, and South-Western Railroad is incorporated by J. H. Farley, W. L. Bradley, F. D. Stout, and others, of Dubuque.

KNOXVILLE, TENN.—A company has been formed to build a street-car line to the West End.

LAWRENCE, KAN.—A charter was issued August 15 to the Meade Centre, Cimarron Valley and Trinidad Railway Company. Principal place of business, Hugoton, Stevens County, Kan. Directors: A. J. Crothers, L. E. Keiser, W. H. Green, G. S. Stein, and others. The proposed line is from Meade Centre to Trinidad.

DULUTH MINN.—The Duluth Terminal Company will build a line along the shores of St. Louis and Superior Bays, and across Superior Bay from Rice's to Minnesota Point, the main object being to enter Duluth. One proposition is to bridge the St. Louis about Fond du Lac.

SELMA, ALA.—The Selma Land Improvement and Furnace Company have completed arrangements to build the proposed Selma and Cahaba Valley Railroad. Work will doubtless commence at an early date.

LITTLE ROCK, ARK.—Articles of association have been filed with the Secretary of State for a road to be built by the Eldorado and Southern Railroad Company. The capital stock is \$300,000. The road will run from Camden to Eldorado, in Union, Ark., a distance of twenty-five miles.

MISCELLANEOUS.

NEW ORLEANS, LA.—Assistant Engineer Douglas has staked out four miles of levees to be built.

MILWAUKEE.—Norcross Bros., of Boston, are making a 14-ton pedestal for the 1,200 pound Lieft-Ericsson statue at the head of Martin Street. Mrs. Gilbert presents it to the city. The sub base is eight feet square.

TACOMA, W. T.—Dennis Ryan and a company of Eastern capitalists have begun the erection of smelting and reduction works in Tacoma. The capital stock of the company is placed at \$2,000,000, and the works are to turn out 400 tons of ore daily.

GOVERNMENT WORK.

WILMINGTON, N. C.—Bids for furnishing 5,000 tons stone for and dredging in Cape Fear River, N. C., received by Captain W. H. Bixby, Corps of Engineers:

(1) For furnishing 5,000 tons stone, opened September 1: John S. Howell, New York, \$2.17½ per ton delivered at works; George F. French, Rocky Point, N. C., \$1.66½ per ton delivered at Wilmington (\$1.84½ per ton delivered at works).

(2) For dredging, opened September 5: Rittenhouse Moore, Mobile, Ala., 13½c. per cubic yard, scow measure; Atlas Dredging Co., Wilmington, N. C., 13½c. per cubic yard, scow measure.

NEW YORK CITY.—Bids were opened at the Army Building, September 7, by George McC. Derby, Lieutenant of Engineers, U. S. A., for dredging in Raritan River, N. J. The engineer's estimate called for 4,800 cubic feet of dredging, 700 of which was rocky bottom. The following were the bidders: M. K. Pidgeon, New York City, dredging rocky section, \$14 per cubic yard in scow; remaining work, 47c. per cubic yard. Hartford Dredging Co., Hartford, Conn., rocky section, \$25; remainder, 60c. Elijah Brainard, New York City, rocky section, \$15.20; remainder, 49c.

THE bids for dredging Raritan and South Rivers, N. J., are considered too high, and the work will be readvertised.

ASHEVILLE, N. C.—The following bids for construction and repair of levees in Arkansas were opened September 2 by Captain William T. Rosell, U. S. Engineers:

J. M. Whitehall, Arkansas City, Ark., loops, Arkansas City to Amos Bayou, 2¼c. per cubic yard.

P. J. Lamb, Memphis, Tenn., loops, 20½c.; Panther Forest extension, 22c.; Leland ad loop, 10½c.; Brook's Break, 21½c.; Matthew's Bend, 21½c.

George Arnold & Co., Whiskey Extension, 39½c.; Brook's Break, 22c.; Matthew's Bend, 22c.

Timothy Sullivan, Memphis, loops, 32c.; Panther Forest, 20c.; Leland Loop, 19c.; Whiskey Break, 80c.; Brook's Break, 30c.; Matthew's Bend, 32c.; Grand Lake, 29c.

J. M. Namary, New Orleans, Matthew's Bend, 27c.; Grand Lake, 26c.

A. A. Arnold, C. F. Degans, Memphis, Tenn., loops, 21½c.; Panther Forest, 23½c.; Leland Loop, 22c.; Matthew's Bend, 24½c.

Andrews Bros., Florence, Ala., loops, 10½c.; Panther Forest, 10½c.; Leland Loops, 18c.; Whiskey Extension, 18c.

E. F. Verdit, Memphis, Whiskey Extension, 39½c.; McTighe & McKee, Memphis, loops, 21c.; Panther Forest, 10½c.; Leland Loop, 18c.; Whiskey Extension, 40c.; Brook's Break, 30c.; Matthew's Bend, 20½c.; Grand Lake, 22c.

J. J. Cooney, Memphis, Tenn., loops, 20c.; Leland Loop, 20c.; Matthew's Bend, 20c.

G. C. Dulany, Rosedale, Miss., Leland Loop, 16c.; Matthew's Bend, 20c.

Craig & Worthington, Lakeport, Ark., Leland Loop, 23c.; Whiskey Bend, 34½c.

W. R. Harney, Memphis, loops, 19c.; Panther Forest, 10c.; Leland Loop, 17c.; Whiskey Bend, 34c.; Brook's Break, 18c.; Matthew's Bend, 19c.

Craig & Graves, Sterling, Ark., Grand Lake, 26c.

Arnold & Flynn, Memphis, loops, 22c.; Panther Forest, 23½c.; Leland's Loop, 21c.; Whiskey Bend, 38½c.; Matthew's Bend, 23½c.; Grand Lake, 25½c.

Toppen & Fisher, Fruar's Point, Miss., Loops, 17c.; Leland's Loops, 17½c.

Daniel F. Hartwell, Memphis, Panther Forest, 22c.; Leland Loop, 18½c.

John B. McGinty, New Orleans, Brook's Break, 23c.; Matthew's Bend, 22c.; Grand Lake, 23½c.

Hugh Fernan, Memphis, Loops, 22c.

NEW ORLEANS, LA.—The following bids for 660,000 cubic yards of levees at Kempe and Deer Park were received by Captain D. C. Kingman, U. S. Engineers:

C. S. Jones and J. W. Ogden, Kempe, per cubic yard, 28½c.; Deer Park, 15.00c.

Robert M. White, New Orleans, La., none; 14½c. respectively.

Rogers & Ballantine, New Orleans, La., 30c.; none, respectively.

John S. McTighe & Co., Memphis, Tenn., 38c.; 17c. respectively.

John P. Kennedy, New Orleans, La., 34c.; 16½c. respectively.

Patrick Harrigan, New Orleans, La., none; 21c. respectively.

William Curry, St. Joseph, La., none; 19½c. respectively.

Albert G. Ober, New Orleans, La., none; 18c. respectively.

Michael B. McGarry, New Orleans, La., none; 16.74c. respectively.

Robert McNamara, New Orleans, La., 28½c.; 17c. respectively.

BALTIMORE, MD.—The following bids for metal-work for Harbor Island Light, N. C., were received by Captain J. C. Mallory, U. S. Engineers, September 3:

Colwell Iron-Works, New York, \$5,608; West Point Foundry Association, Cold Spring, N. Y., \$6,230; Phoenix Iron Co., Trenton, N. J., \$6,000; Allentown Rolling Mills, Allentown, Pa., \$5,600; H. A. Ramsay & Son, Baltimore, Md., \$7,950.

WILMINGTON, N. C.—The following bids for 5,000 tons of stone for improving Cape Fear Breakwater were received by Captain W. H. Bixby, U. S. Engineers, September 1:

John S. Howell, New York, N. Y., \$2.17½ per ton of 2,240 lbs. delivered at works.

George Z. French, Rocky Point, N. C., \$1.66½ per ton of 2,240 lbs. delivered at Wilmington (\$1.84½ delivered at works).

WOOD'S HOLL, MASS.—Owing to some informalities in the opening of bids for corrugated iron-work on the buildings for the Fisheries Commission they will be readvertised.

WASHINGTON, D. C.—Bids for erecting a house and appurtenances at Point Jupiter, Fla., for the use of the Signal Service, were opened September 1 by General A. W. Greeley, Chief Signal Officer, U. S. A., as follows:

W. G. Toomer, Jacksonville, Fla., \$4,000; W. A. Miller, Sanford, Fla., \$3,121.80; John & George W. Hufbauer, South Jacksonville, Fla., \$3,230; A. D. Pitts, Titusville, Fla., \$2,736.95; J. H. Caster, Baltimore, Fla., \$6,750; W. H. Sincell, Washington, D. C., \$9,000; C. C. Haight, Lake Worth, Fla., \$3,173.92; A. P. Dye, Lake Worth, Fla., \$2,743.

NEW YORK CITY.—Bids were opened at the Army Building, on September 7, by George McC. Derby, Lieutenant of Engineers, U. S. A., for dredging in South River, N. J. (under circular). The following were the bidders: M. K. Pidgeon, New York City, 40 cents per cubic yard; Jas. McSperritt, Jersey City, 35 cents per cubic yard; Hartford Dredging Co., Hartford, Conn., 30 cents per cubic yard. About \$40,000 is involved in the undertaking.

GALVESTON, TEX.—The following bids for protecting the shore of Arkansas Pass, Tex. (88,000 cubic yards of rip-rap), were received by Major O. H. Ernst, U. S. Engineers, September 2:

Gus Wilkie & J. W. Rickey, Austin, Tex., \$3.89 per cubic yard.

Louisiana Jetty and Lightering Co., New Orleans, La., \$3 per cubic yard.

T. H. Micklejohn, San Antonio, Tex., \$3.18 per cubic yard.

Charles Clarke, Galveston, Tex., \$3.35 per cubic yard.

A. M. Shannon & Co., Galveston, Tex., \$2.95 per cubic yard.

SYNOPSIS of bids for extension, Post-Office, etc. Peoria, Ill., opened September 1 by the Supervising Architect: John Angus, \$33,975; Jobst Bros., \$28,960.80; Larkworthy & Mencke, \$24,879.

SYNOPSIS of bids for materials, tools, and labor for plumbing and gas piping for Court-House, etc., Council Bluffs, Iowa, opened September 5 by the Supervising Architect: J. C. Bixby, \$1,543; A. L. Strang & Co., \$2,700.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 16. } PUBLISHED EVERY SATURDAY.

NEW YORK, SEPTEMBER 17, 1887.

LONDON, OCTOBER 1, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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THE CENTENARY OF STEAM.

We give space elsewhere in this issue to print a communication to the editor of the New York Times, intended, in this centennial year of the adoption of the Constitution of the United States, to ask the American public to do justice to the memory of the inventor of the high-pressure steam-engine, the value of whose work to mankind it is impossible to estimate. The Times says:

"On British soil there is a monument bearing upon its face the legend, 'Inventor of the Locomotive.' That proud title was never borne by Stephenson while he lived, nor was it, in fact, ever earned by him. On the contrary, that contemporary British journal which describes the running of the first train on the Liverpool and Manchester Railway, in that same number narrates facts which entitle an unfamed American to even greater honors. Just one hundred years ago this unhonored citizen of the Nation born in that year patented a device embodying the essentials of an invention surpassing Stephenson's or even Watt's. His invention was complete nearly ten years previous, and it was put to practical test in actual daily use several years before Fulton built the first steamboat, and a score of years before Stephenson built the 'Rocket' and made the remark about the cow. Certainly in this centennial year every American should be reminded that on our soil, and in the brain of a fellow-citizen, were first conceived ideas which, even in their stupendous development, have not surpassed the recorded conception of a man whose name ought fairly to be on every schoolboy's lips, but yet which is unfamiliar if not unknown to even well-informed adults. Foreigners concede his claims and erect false monuments to his inferiors. Yet probably it is now too late, and probably Americans are too preoccupied, for his fame, which should be their glory, to make fit headway. The reproach is theirs, but all the more it is useful to recall in this hundredth year what this man did for the world."

In republishing this communication, and thus calling attention to it, THE SANITARY ENGINEER AND CONSTRUCTION RECORD desires to suggest to the American Society of Mechanical Engineers the propriety of their appointing a committee to prepare a report that, besides doing justice to the inventors of that time, will contemplate a practical movement to be carried on under auspices of the society to secure a more general recognition of the services of Oliver Evans. Included in this should be a movement to secure a fund for the erection of a suitable memorial to be placed in Washington, the capital of the country, and on soil that was in his day a portion of the State that granted him his patent. To such a fund we would gladly contribute.

REMOVAL OF GRADE-CROSSINGS IN CONNECTICUT.

It is gratifying to learn that the directors of the New York, New Haven and Hartford Railroad have at last decided to adopt a more public-spirited policy in the management of that prosperous and wealthy road. THE SANITARY ENGINEER AND CONSTRUCTION RECORD has several times called attention to the murderous grade-crossings that have too long been tolerated by that corporation, and the several recent fatal casualties at these crossings between New York and New Haven and the public indignation thereat seems to have at last induced the management to prepare plans and specifications looking to their abolition. There are yet over one hundred of these crossings in the State of

Connecticut between the New York State line and New Haven, though in this State many of them have already been changed. This wise move, together with the proposed erection of new depots of good architectural design, the adoption of steam-heat and electric-lights as a substitute for the car-stove and kerosene oil, and other improvements in the road-bed now in progress, will soon result in its being held up as a model road, as the Pennsylvania for some time has been.

DEATH-RATES OF DIFFERENT CLASSES.

WHATEVER one may believe as to the truth of the declaration that all men are born free and equal, it must be admitted that they do not remain so. If any evidence of this were needed, it could easily be furnished on one point—viz., that the death-rates of different classes of men are not equal; that the chances of life, and the probable length of life, are very different in what are known as the upper, middle, and lower classes. For example, Dr. Farr's life-table of England, based on the data for the 17 years 1838-54, gave as the mean duration of life of males about 40 years. Mr. Humphreys' life-table, based on the records of the five years 1876-80, gave the mean duration of life of males as 41.9 years, showing marked improvement. Taking the healthiest districts in England, in which the mean annual death-rate did not exceed 17 per 1,000, Dr. Farr constructed a healthy district life-table from the records of 1849-53, which gave 48.6 years as the mean duration of life for males. All the above life-tables include all classes of population. The life-tables of the English peerage show a mean duration of life of 52 years for males, and Mr. Ansell's table for the upper classes gives the mean duration of life as 53.1 years. These differences, as pointed out by Mr. Humphreys, are largely due to the low death-rate among children under five years of the peerage and upper classes, since the annual death-rate of children under five years of age ranges from 65.7 per 1,000 by the general table, 39.4 by the healthy district table, and 28.2 by the upper class table, to 20.7 by the peerage table. There are no life-tables for the working classes from which we can make corresponding comparisons. The best data that we have for this purpose are some of the English statistics with regard to mortality by occupations, and some statistics of class mortality published by Dr. Grimshaw, the Registrar-General of Ireland. All of these are discussed in a carefully prepared paper by Mr. N. A. Humphreys, published in the journal of the Royal Statistical Society for June, 1887, under the title "Class Mortality Statistics." By Dr. Grimshaw's figures the annual mortality among children under five years of age was, per 1,000, for the professional and independent class, 22; the middle class, 59; the artisan class, 71; and for the general service class, 110. Mr. Humphreys remarks that this wholesale slaughter of the sickly children of the working classes does not increase the vitality of the survivors in the next age period (5-20 years), the death-rate of which is, per 1,000, for the professional and independent class, 3+, and for the three other classes, in the order above given, 8, 9, and 11 per 1,000.

Now, in view of these figures, and of many others of similar tendency which may be found in the papers above referred to, it is evident that one of the first things needed as a guide for intelligent effort to improve the condition of the working classes is definite and positive information with regard to their death-rates and the causes of death which chiefly affect them. In this country we have practically no data for class mortality statistics, and with our present machinery for collecting vital statistics, whether State or municipal, it is not possible to obtain such data as would be required to settle these important questions.

The trades-unions and the Knights of Labor could do it if they began in the right way, by getting expert advice as to how to do it, and when it was done they would have some definite foundation for a statement of their case—something that would show where the shoe pinched. We commend this subject to the consideration of the managers of trades-unions, and the promoters of reform in general; it would have more practical effect than all the denunciations that can be produced.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, when the contracts were let, predicted the work would not be done in the time specified. The failure, however, to begin the Quaker Bridge Dam makes the time of completion of the aqueduct of secondary importance, since it is likely to be finished before it can be fully utilized.

BRITISH CORRESPONDENCE.

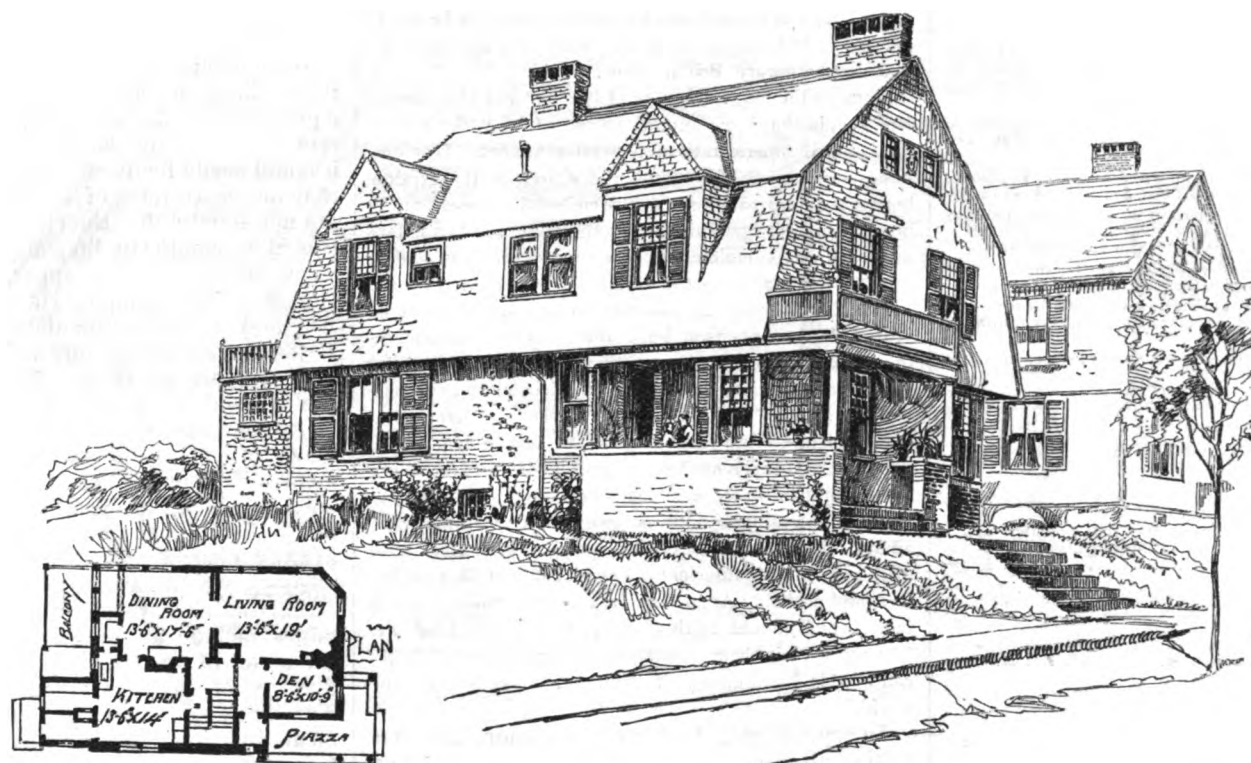
THE scheme of the enterprising corporation of Birmingham for supplying power by compressed air for driving-engines, etc., is taking definite form, and the plant is nearly complete. The corporation's engineer states that for a nominal eight-horse-power engine it is estimated that the cost of supplying necessary power would be £13 (\$62.40) per I. H. P. per annum, as against £17 (\$81.60) on the old system.

A PECULIAR engineering scheme is under consideration at Southport in Lancashire. The place is a seaside resort, but labors under a very great disadvantage, inasmuch as at ordinary tides the sea does not come to within two miles of the marine parade. To remedy this, it is proposed to erect at the ordinary high-water mark, between the sea and the parade, a sort of breakwater, with a view

engines and staff throughout London were present at the fire, and that had another fire of any magnitude broken out there was not sufficient force to grapple with it. A penny-wise and pound-foolish policy is adopted, whereby in any case in which the first few engines are run out of headquarters, the men have to rush out to various contractors, trying to get horses to horse the remaining engines, thereby losing valuable moments in the early stages of a fire, which are of course irrecoverable.

LONDONERS are promised additional comfort throughout the winter months in public conveyances by the introduction of the electric-light in tram-cars and omnibuses. There is a very enterprising company—namely, the London Road Car Company—which has only been upon the road for some eighteen months or two years, but which has already been able to force the London General Omnibus Company, hitherto, comparatively speaking, monopolists, to lower their rates. Several vehicles of this Road Car Company have just been fitted with the electric-light, and the conductors assert that it works very satisfactorily, and gives them no trouble.

In a recent paper contributed to the *Zentralblatt der Bauverwaltung*, by Mr. R. Hinkeldeyn, on "Building



RESIDENCE OF JOHN CALVIN STEVENS, PORTLAND, ME.

CHICAGO SEWAGE PROBLEM.

We have a communication from Mr. Gordon Nott, whose scheme for dealing with the sewage of Chicago was criticised in our issue of August 20. Besides being too long for publication, there is no important information given concerning what he proposes to do beyond what we gave in the former article.

We are still of the opinion that the most practicable plan for dealing with the Chicago sewage is by a canal of sufficient capacity to dilute and remove it, as proposed by the commission of engineers appointed by that city and explained in our former article.

THE TIME EXTENDED FOR COMPLETION OF THE CROTON AQUEDUCT.

THE Croton Aqueduct Commission have extended the time in which O'Brien & Clark and Brown, Howard & Co. were to complete their work on the New Aqueduct to eight months from September 20. The Commissioners explained the extension of time to the contractors by the statement that unforeseen obstacles had been met with in making the tunnel, and that it had been decided to line the tunnel with brick after the original contracts had been awarded.

to ponding the sea-water facing the parade in a sort of inland sea. The proposed breakwater would be made sufficiently wide at the top to form a parade or a drive, and would be in the shape of a continuous tunnel, provided on the seaside with a sort of lip or trough communicating with the tunnel by numerous inlets. This trough, which is on the outer slope of the breakwater, will run its whole length. The sea, rushing up the side of the slope, would deposit the water in the trough, whence it would flow into the tunnel under the breakwater, by which it is conducted through syphons into the inner basins of the artificial sea. To provide against evaporation, it is proposed to have a pump driven by a wind-motor and a fan, the pump being capable of delivering 20,000 gallons per hour. The scheme is the combined invention of Mr. E. Lightowler, of Southport, and Mr. B. H. Thwaites, C.E., of Liverpool. It is assumed that in the course of passing from the sea proper to the inland sea, any organic matter would be deposited in the tunnel of the breakwater, whence it could be flushed out by a sluice-valve at the end.

THE recent large fire at Whiteley's, the 'Universal Provider,' has again emphasized the state of affairs with regard to protection by the fire-brigade, which is distinctly deficient in quantity and material. It is stated by the fire-brigade authorities that the bulk of the

Construction," with no small measure of praise of the great care and excellent work done in sanitary engineering in this country, also speaks of the recently established chair of sanitary engineering at Columbia College, and thinks it a move in the right direction, and one that will give excellent results.

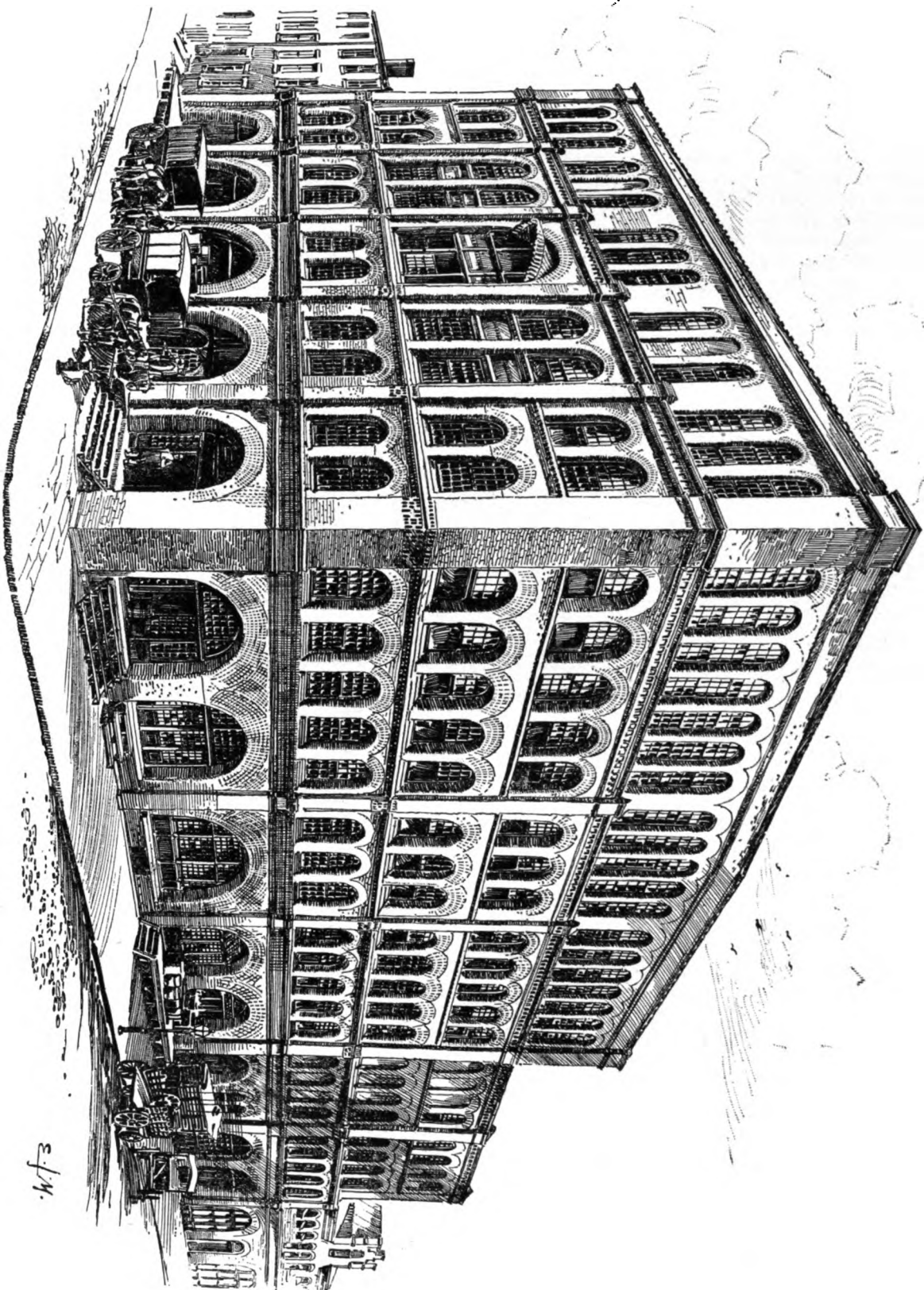
OUR SPECIAL ILLUSTRATION.

A MANUFACTORY.

THE subject of our special illustration is a building for manufacturing purposes, owned by Mr. C. De Hart Brewer, 100 feet on Washington Street and 265 feet on Herbert Street, this city. The ornamental bands are of Philadelphia brick and terra-cotta; common selected Haverstraw brick used elsewhere. Jambs of all openings of rounded "Peerless" brick. The cost was \$82,000. The architect was Henry R. Marshall, of New York.

OUR VIGNETTE ILLUSTRATION.

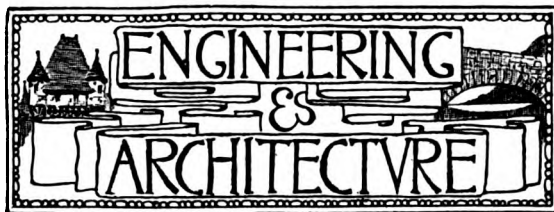
THE subject of our vignette illustration is the house of Mr. John Calvin Stevens, architect, Portland, Me. The first story is rough brick; all above shingled and stained. Finish mostly whitewood, stained. Hardwood floors on first story. Cost, \$4,600.



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

A MANUFACTURING BUILDING.

H. R. MARSHALL, ARCHITECT.



BUILDING CONSTRUCTION DETAILS.

No. VI.

(Continued from page 69.)

STABLE-FLOOR CONSTRUCTION.

THE following letter from Captain Pond, United States Army, suggested a useful line of inquiry. A number of stables in New York and Boston were therefore examined, and the data herewith given is the result of that investigation. We should be glad to have any of our readers supplement this information or indicate to us where we may obtain further data on this subject.

FORT RILEY, KAN., August 4, 1887.

SIR: Would it be asking too much to request you to inform me, either by letter or in your columns, of the most approved method of flooring stables for a large number of animals? I am to construct a number of stables for cavalry and artillery. It is desired to floor them to secure drainage and prevent dust. I have two methods in view: (1) To floor throughout with 2-inch yellow pine; (2) to concrete throughout, Barber asphalt the drives, and floor the stables. The cost will be about the same. Which is the best, or are there better methods? Of course I intend to have a complete system of drainage, with suitable flushes, traps, etc. An answer as above will be much appreciated. Respectfully yours, GEORGE E. POND, Asst. Qr. M., U. S. A.

MATERIALS USED FOR FLOORS OF LARGE STABLES IN NEW YORK AND VICINITY.

Adams Express Company's Stables, Jersey City.—Stalls are provided for 190 horses. The first floor is laid with cement-concrete in a monolithic sheet. This has cracked in many places, which would have been prevented by laying it in sections 6 feet square. A number of stalls are located on this floor, and also several box-stalls, which are 10 feet square.

The second floor is supported on iron columns and girders, on which the wooden joists rest. The floor is composed of yellow-pine planks 3 inches thick and calked in the same manner as a vessel. The stalls are 9x5 feet, with gutters for drainage provided outside of the partitions by cutting a groove in the floor. This connects with drain-pipes about 33 feet apart, which are carried down the iron columns to the sewer. This gutter is covered with boards laid down loosely flush with surface of floor, and made in sections of about 8 to 10 feet each. The floor of stalls and alleyway between slope toward these gutters.

The stall floor is covered with slats made of spruce about 2 inches thick and from 3 to 4 inches wide, fastened together by cleats on under surface, which raise it from floor, permitting urine to flow freely to gutters. The space between foot of stalls is about 10 feet wide, and alleyway at head of stalls is 4 feet wide, the latter utilized when feeding. The drains connect with gutters by means of square iron frames 9x9 inches, in which is fitted a perforated lid 7 inches in diameter. There is no complaint made of horses slipping.

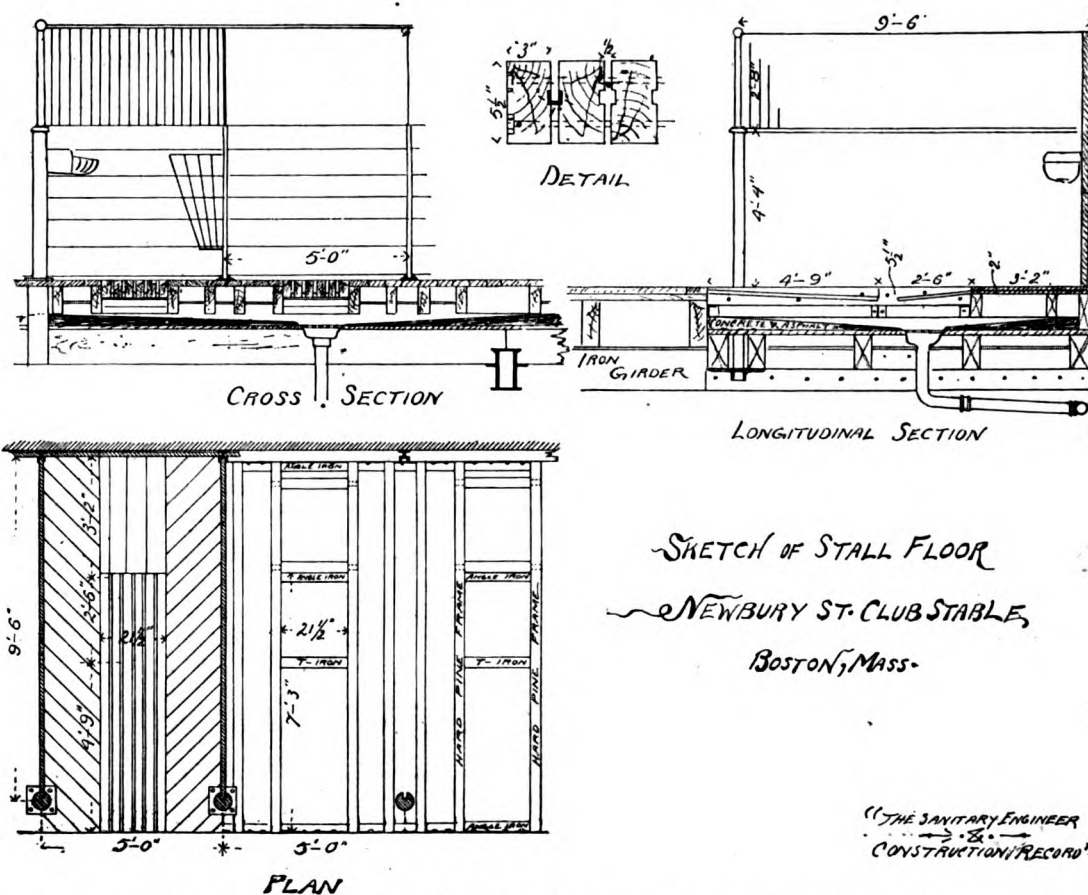
United States Express Company's Stable in Jersey City.—Their building is of brick and will accommodate 300 horses. First floor laid with plank and utilized for storage of wagons and for office. The second floor is supported on iron columns and girders on which the wooden joists rest. On these joists 3-inch plank is laid for the floor. On this floor is laid two thicknesses of prepared felt and covered with Neuchatel asphalt, which is laid with smooth surface in the stalls but corrugated in all passageways between them. The stalls are about 9'6"x4'8", with gutters made in the asphalt at foot of stalls, which are connected with drains similar to those described in the Adams Express stables. In a portion of the passageways where horses are compelled to turn short, sand is sprinkled, whenever horses are smooth-shod, to prevent slipping, but sand is not used when shoes are well calked. A recent fire destroyed all of the wood-work of second floor and everything above it, except the brick walls, but left every part of this floor intact that was covered with this asphalt. The first floor is now used the same as before the fire. Two

more stories will soon be added and asphalt used throughout. The superintendent stated that he would not use any other material, and that the whole building would have been a total loss had the second floor not been protected with this material.

Riding-School Stable, Fifty-eighth Street and Seventh Avenue.—Both wood and Seyssel asphalt are used here for floors. The stalls are covered with slats made of oak two inches thick, and there are covered drains at foot of stalls.

American Express Company's Stable, Forty-eighth Street and Lexington Avenue.—This building is new, composed of brick with second floor supported on iron columns and girders and provided with a large elevator. The stalls visited were in the basement and will accommodate several hundred horses. This floor is made of cement concrete or artificial stone, smooth on surface in the stalls, and corrugated in 4-inch squares in all passageways. The stalls are 4'8"x10', with depressions for drainage in each stall about two feet from rear end of partitions, the floor surface in and adjacent to this depression made sloping to it. In each depression is set an iron frame 9x9 inches, which supports a circular perforated lid seven inches in diameter connecting with drains and thoroughly trapped.

Floor of stables is covered with spruce slats made in three sections for convenience in cleaning, the forward



half in one piece and rear half in two parts, divided longitudinally.

There was no complaint of horses slipping, and drainage appeared to be perfect. The sloping passage to main floor for horses covered with five inches of tan bark.

Jacob Rupert's Brewery Stables.—These are small one-story frame buildings, with stables on surface of ground.

The foundation is made of concrete covered with 3-inch spruce plank. The stalls are 4 feet 8 inches to 5 feet and 10 feet long, with board drains outside of stalls covered with boards flush with floor. Floor of stalls covered with birch plank.

The foreman states that they had used both artificial stone and asphalt, but abandoned them on account of their slipperiness.

De Kalb Avenue Horse-Car Stables, Brooklyn.—These stables will accommodate 500 horses, and the floor is covered with Seyssel asphalt, having a smooth surface throughout the whole second floor, where stables are located. Stalls 5x10 feet, and passages 7 to 10 feet wide. The surface of both stalls and passages slope toward gutter at foot of stalls. Floor of stalls covered with spruce slats.

But little trouble is experienced with horses slipping, and to prevent any possible chance of their doing so, the surface of passages are kept sanded.

The foreman of stable is with the material.

SUMMARY OF INFORMATION OBTAINED IN NEW YORK.

In all stables where first cost of construction is considered only spruce plank is used, as it at all times gives a firm footing for horses, and is convenient to repair when stalls are located on first floor; but where leaks occur when stalls are on the second floor they are often very expensive to repair, as any fluid will frequently show itself at a long distance from cause of trouble.

Yellow pine is not favored, as the urine causes any sappy portion of planks to decay quickly.

Concrete or artificial stone is but little used on account of slipperiness after long use, as its wearing surface becomes smooth, the same as paving-stones. The American Express Company's stables are new, and therefore not thoroughly tested.

The only asphalt used in this vicinity is the natural rock. The weight of testimony of those who have used Seyssel and Neuchatel rock asphalt appears to be in their favor.

The only objection is to its slipperiness, but those now using it and stabling the greatest number of horses favor it. A little sand sprinkled on surface removes all fear of horses slipping when smooth-shod. It has many points in its favor—imperviousness to water, and is not affected by acids of urine, can be cleaned with a minimum amount of labor, and is fire-proof.

It does not affect horses' hoofs, as its constituent elements are not evolved except at a high temperature.

BOSTON.

Newbury Street Club Stables.—Peabody & Stearns, Architects.—In this stable the stalls are located on the second floor, over the carriage-rooms.

There is a line of stalls down each side of the building and one line down the middle.

The stalls are 5x9½ feet. The sides and front to a height of 4 feet 4 inches are hard pine, 2-inch plank; above this is an iron guard, 2 feet 8 inches high, of ½-inch round iron. At the head of the stall, on the left, is a cast-iron feed-box in two sections, one being covered and set 3 feet 4 inches from the floor. In the right-hand corner is the hay-rack set at the same height, to be eaten out of from the top.

The under floors of the stalls are set somewhat lower than the rest of the floors, and the areas concreted over. Each section of three stalls is dished toward the centre of the middle ones, where is set a cast-iron cesspool and grating connected below the floor to the soil-pipe. The surface of the concrete is finished off in asphalt.

The line of floor-joists at the head and foot of stalls have a wrought-iron angle-iron bolted to them, on which rest hard pine frames, which are mortised together, and

form the support of the stall floor. Down the centre of the stalls are placed two sections made up of 3x5½-inch hard pine bolted together, with cast-iron drainage-grooves set between each; these are sloped from each end to the centre of the stall. The rest of the stall is floored with 1¾-inch hard pine laid in 6-inch strips, bearing true on either side of the middle and straight-wise at the head.

The 3x5-inch portions are in two sections 21½x30 and 21½x57 inches. By raising the shortest section in the middle one of three stalls, access is had to the cess-pool below. The cast-iron grooves are one inch square outside, and the 3x5½-inch hard pine sticks have to be rebated on an angle, so as to give the necessary fall to this groove, which is 2 inches in the 4'x9" strips. On the 2'x6" strips the gutter is but 24 inches, leaving a 6-inch space at the middle for the drippings to fall through to the asphalt surface, from which it flows to the cesspool.

This building was only put up this year, and has not yet been used, so that the working qualities of the arrangement has not been tested.

(See sketch.)

Highway and Fire Department Stable at Newton.—In alterations, a floor of ¾-inch spruce was first laid over the whole area, on which tarred sheathing-paper was spread. An upper floor of best quality 1½-inch maple was laid over this, well planed, jointed, and made tight; this extended to the gutters which ran along the rear of the stalls. In the stalls A. F. Hall's patent cast-iron stall bottom was used, fitted with maple plank, and the rest of the stall fitted out with 2-inch maple laid crosswise at the head of stalls. The cast-iron gutter at the foot had a maple-plank cover. This Hall's patent is a casting some five feet long, the upper surface of which has projecting ribs into which are fitted 2x4½-inch maple planks, and between which are the drainage grooves which are sloped toward the rear of the stall. It is some little work to fit in the plank so as to have them tight, and if not tight, urine will get in and rot them from below.

In this particular stable the manure is kept in the basement right below the stalls. In order not to soak down the manure with all the floor washings, lead pipes were attached to the outlets of the gutter, and bent so as to deliver opposite and a little above an open T on a line of drain-pipe suspended from the floor joists. The ordinary dripping would thus fall on the manure, but when running full from floor washing the stream would strike in the bell of the T and be carried off in the drain, which was trapped at the wall.

A drying-room for bedding was also arranged in this stable. It was a room partitioned off next to the outside wall with two windows in it and opening near the floor

Metropolitan Horse-Car Company's Stables.—The Bartlett Street stables contain some 350 stalls. The car-shops are located in an adjoining building, and some additional accommodations for horses are being prepared at the present time.

Mr. Isaac Randall, who has charge of the car-shops and the repairs and additions being made to the stables, states that at one time the different car stables were fitted with iron drainage gutters in the stalls, but owing to the extra expense of preparing and getting out the stock for them they were abandoned some years ago.

The method now adopted is that which is being used in the new stalls at the Bartlett Street stables, which is as follows:

The whole area of the stables, which are located over the car-depot, is decked over with 3-inch plank, thoroughly calked with oakum and made water-tight. This forms the surface of the passageways.

In the stalls a boarding of inch spruce is put on and nailed tight. Over this is laid a floor of 2x4-inch spruce laid crosswise at the head of the stall and lengthwise on the rear 5 feet. This rear part is laid with a space of ½ an inch between each plank, forming a drainage groove, terminating in a hard pine gutter which is set in the floor along the rear end of the stalls.

The 2x4-inch spruce planks are found to wear out from the pawing and scraping of the horses' feet long before the spruce boarding below it is rotted by the urine and manure which get into the drainage grooves; and several sets of the 2x4-inch are used up before it becomes necessary to replace the boards below.

No doubt hard wood, elm or maple, is much better than spruce for the stall floors, but it is much more expensive and much harder to obtain. It must be got out a long time ahead and kept on hand to be used in repairs, as it cannot be found on the market at any time as the spruce can. Maple stock cost two and a half times as much as the spruce and is much more work to put down, and the experience with the company is that spruce is more economical.

The stalls are built in double rows facing each other, the sides and head partitions being of plank and run up some 8 or 9 feet. But the space under the feed-trough is left open for purposes of ventilation and ease in cleaning out. The trough is of spruce plank, with an iron strip screwed on the upper edge.

Most of the stalls are double, intended for a pair of horses.

At the South City stables, for highway horses, some 150 horses are kept.

Here the stalls are in two rows facing each other, but with a wide passage of some 10 to 15 feet between. The

gutter which runs along the rear of the stalls. This gutter is left open at the South Stables.

At the Highland Stables the gutter at the foot of stalls is covered with plank, and the plank in the stalls are 2x6-inch spruce. In some places where the floor has been renewed the new 2x6-inch plank has been laid over the old, making the drainage grooves come over the middle of the old planks. At this stable there is a double plank floor over the whole area on top of the first rough boarding.

The stables of the Health Department, near the jail, on Charles Street, are also arranged in a similar way.

These stables are very high studded and well supplied with windows. The stalls being out on the floor, the ventilation is good.

The bedding in the daytime is kept in an iron crib along the outside walls in the rear of each stall, is easily accessible, out of the way, and gets a pretty good airing.

In the Fire Department engine-houses hard-wood floors are used throughout, hard pine or maple. The stall have hard-wood strips 2x4 inches set ½ inch apart and iron gutter along foot of stalls only.

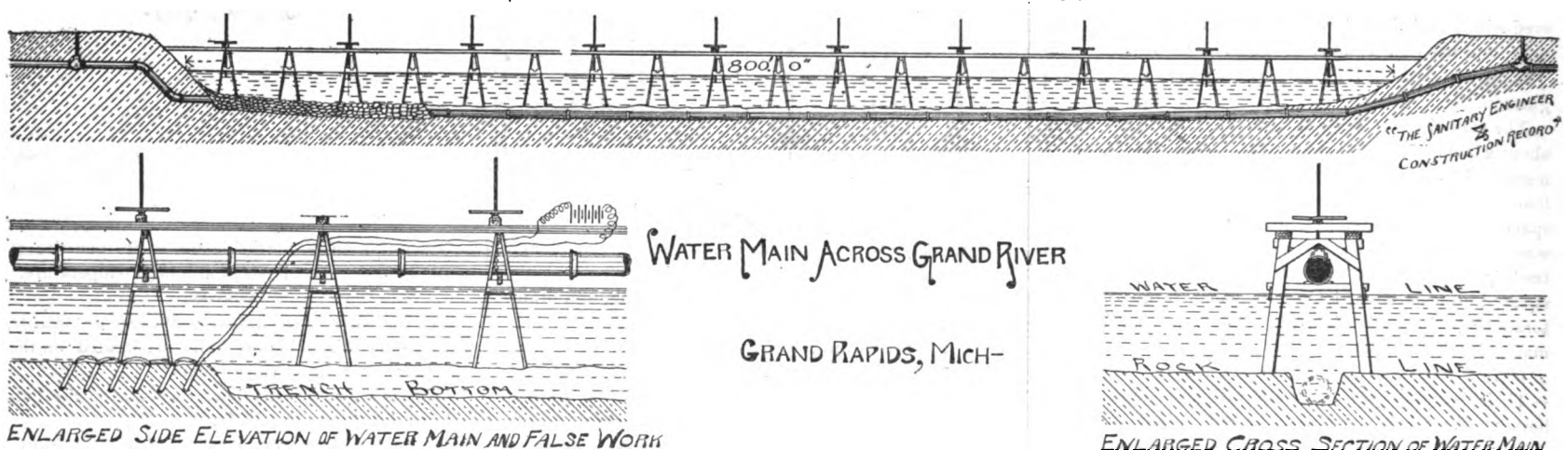
In most of the large livery stables and cab stables hard pine is also used for the floors and stalls, with wooden drainage gutters, and cast-iron gutters at foot of stalls; usually covered by planks removable in sections at each stall.

CARRYING WATER-MAINS ACROSS A RIVER.

KALAMAZOO, MICH, August 26, 1887.

SIR: I recently saw an article in your paper, dated July 9, 1887, page 158, over the signature of J. H. Harlow, of Pittsburg, relative to my paper on "River Crossings for Water-Mains,"* prepared for the last meeting of the Michigan Engineering Society. Mr. Harlow seems to think that there was no call for that paper. It was prepared by request of the president of the society. Still I should not have offered it had I not felt that there was great need of a better knowledge relative to this kind of work. I think if Mr. Harlow will study that paper in a different spirit, and until he fully comprehends it, he will certainly greatly profit by it.

To compare the crossing of the St. Joseph River at Elkhart, Ind., with the crossing at Grand Rapids, Mich., is simply ridiculous. In the former case the river is only about one-third the width of the Grand River, and the river-bed is gravel instead of rock, as at Grand Rapids. It would have been very easy to have made a trench in the river bottom at Elkhart and covered the pipe, instead of which it is laid without any trench at all, and lies fully exposed to sight, and is in great danger of destruction by ice every winter. At Grand Rapids the pipe is thoroughly bedded in the rock and covered. The



under each window, closed by slides. Just above these openings was the screen on which the bedding was spread. This was an iron frame in sections, with wire netting ½-inch 2x4 mesh, hinged at side opposite to windows, so as to be turned up in order to sweep out the litter below. In this way a current of air could be passed upward through the bedding and thus dry it off.

In some of the stables here Jones' drainage grooves are used. These are cast-iron grooves made in lengths of five to seven feet, and sloping from nothing at one end to an inch or 1½ inches in depth at the other. For these the floor of the stall is laid level. Maple or hard pine plank 2x4 or 2x6-inches is rabbeted out on each side to receive the flange of the groove, which is set with elastic cement. This keeps all liquid from accumulating on the under flooring.

horses are all fed from the head of the stall. For this purpose the front of the stall is planked up only 4½ feet and above is a netting two feet high in wrought-iron frame, which is hinged at bottom. This is turned down for the purpose of shoveling in the feed from the feed-tray, which is on wheels, into the feed-trough in the stall, then the screen is raised up again fastened by bolts to the posts. These screens are of ½-inch wire, woven in 2x4-inch diamond meshes. The floors is laid on 3x12-inch joists, 16 inches on centres, with rough boarding, on which a hard plank floor is laid. In the stalls 2x4-inch spruce planks are laid on top of this, set one-half an inch apart in the rear five feet, and close together in the rest of the stall. These floors have to be furred up so as to slope back and allow the drainage grooves to discharge into the cast-iron

manner of putting the pipe together and lowering to place at Elkhart was very different from the plan adopted at Grand Rapids, and was, I think, quite novel (?). Had it required "two" men "to stand in the water and hold each trestle" while the pipe was being laid, I should have been obliged to have employed 160 extra men during the progress of the work, but I arranged my false work so that it would stand alone, without which it is impossible to do such work properly. It would have been very easy to have done a first-class piece of work in crossing the St. Joseph at Elkhart had the work been properly planned and executed, but, as it is, no reputable engineer ought to have accepted it. Had the work been done like the

*See THE SANITARY ENGINEER AND CONSTRUCTION RECORD, dated June 18, 1887, page 71.

Grand Rapids work, there would have been no breakages and leaks to repair, as has been the case at the Elkhart crossing, requiring much trouble and expense in coffering, etc. I had nothing to do with the Elkhart water-works, except to locate the source of water-supply and make the plans for its development.

Fairbanks, Morse & Co., of Chicago, obtained a franchise, and planned and built the works, J. H. Harlow & Co. doing the work for the company by contract.

Respectfully, W. R. COATS.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XXI.

(Continued from page 291, No. XX.; Article XIX. on page 123.)

DERRICK FOOT-BLOCK AND SHEAVES AT SHAFT 14 ON THE NEW CROTON AQUEDUCT.

SHAFT 14 on the New Croton Aqueduct is situated easterly of Ardsley, a station on the New York City and Northern Railroad.

A depression in the contour of the natural surface on the line of the aqueduct at this point is great enough to bring the crown of the arch near the surface, and therefore permitting the masonry to be constructed in open cut for several hundred feet. At the point where this derrick is located the brick arches have been completed and a portion of filling put in place. To facilitate the

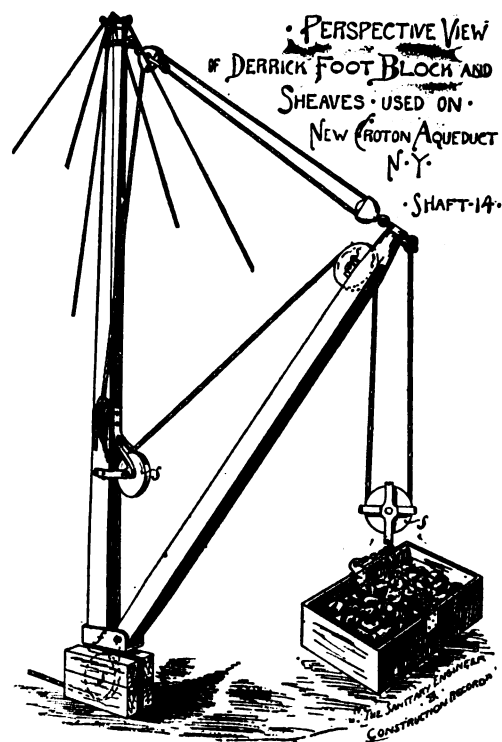


FIG. 72.

removal of material from tunnel headings as the work extends from this point, a small shaft has been built with a height of about 45 feet above grade. The derrick illustrated in Fig. 72 is located over the aqueduct and adjacent to this shaft, for the purpose of elevating the car-box (filled with excavated material) to the surface and deposit contents for filling over the arch. The car-boxes are fitted to trucks in a manner to permit them to be easily detached. The boilers and compressors are situated about 100 feet distant, and a small Lidgerwood hoist adjacent to this shaft is operated by utilizing a portion of the power generated in the plant mentioned.

Before describing the foot-blocks, the large sheaves used on this derrick will be noticed. While there is nothing novel in their construction, yet the large size, two feet in diameter, is noteworthy. The advantage claimed for these sheaves, indicated by *s* in Figs. 72 and 73, are increase of power on account of the diminished friction over ordinary sheaves of eight and ten inches in diameter when wire rope is used. The wear on wire rope is less and the strands are not cut as quickly; the rope, therefore, will bear longer service.

Figure 73 shows the details of the derrick foot-block. No. 1 represents a side view of the foot-block and end of socket-plate, and also the position of lower sheave at *s*, indicating the relative position of the latter in connection with foot-block.

The derrick is supported on four short timbers, each 4 feet long and 12 to 14 inches square, for the purpose of fitting the lower sheave under the mast in a position that

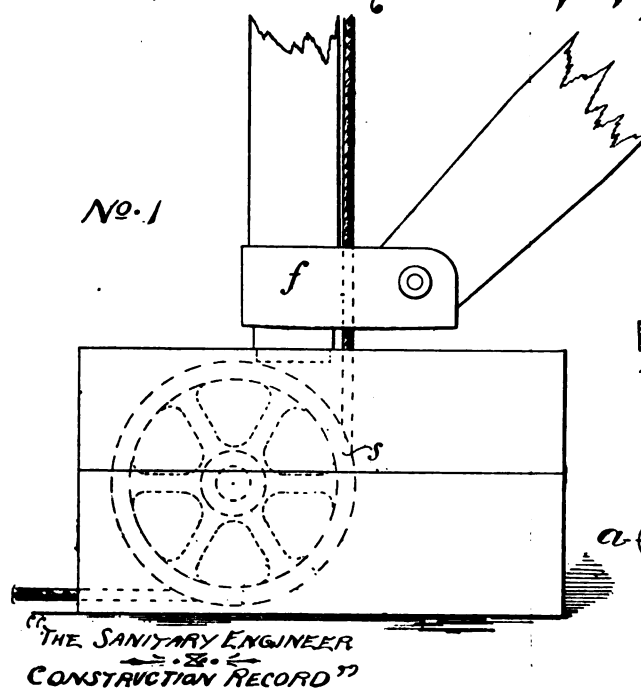
will permit the rope to be operated through the pivot, which is placed between the mast and boom, and not under the mast, the usual position on ordinary forms of derricks now in use.

At *h*, No. 2, is shown plan and section of socket-seats which support the mast. This socket is $7\frac{7}{8}$ inches, and 7 inches in depth. The socket in which the boom rests is indicated at *e*, with dimensions similar to socket for the mast, having a curved surface in a portion of the section, to permit the boom to be fitted easily, and revolved in a vertical position. A pin $1\frac{1}{2}$ inches in diameter is inserted through the plate and boom, holding the latter secure in position. The sides of the casting are three-quarters of an inch in thickness. The pivot is located at centre of foot-block, extending $2\frac{3}{4}$ inches below bottom of socket, and is $4\frac{7}{8}$ inches in diameter, having a hollow centre, *j*, $3\frac{1}{4}$ inches in diameter, through which the rope passes to lower sheave which controls the direction to the hoist-engine.

A projection is made from socket *h*, permitting a $\frac{3}{4}$ -inch rod to be inserted, which can be extended a few feet up the mast, to strengthen and hold it more secure in position on the plate if desired.

No. 3 is a plan and section of socket-plate, which is 8×15 inches and $1\frac{1}{4}$ inches in thickness. This plate has a projection of $1\frac{1}{2}$ inches in depth, and is $7\frac{1}{2}$ inches in

FIG. 73. DETAILS OF DERRICK FOOT BLOCK AND SHEAVES. USED ON NEW CROTON AQUEDUCT, N.Y.



By using this foot-block a mast and boom can be fitted for work in much less time than with ordinary pivot, as it is not necessary to bore a hole in the mast several feet in length for the rope to run in, as required in the common form of derricks, and tools for boring are not always to be had when needed. These foot-blocks are in use at other points on the aqueduct, and we saw them on the new Harlem bridge. They were invented by Mr. P. Kelly, of Poughkeepsie, N. Y., and are made by John Claffy, of 48 Dey Street, New York.

(TO BE CONTINUED.)

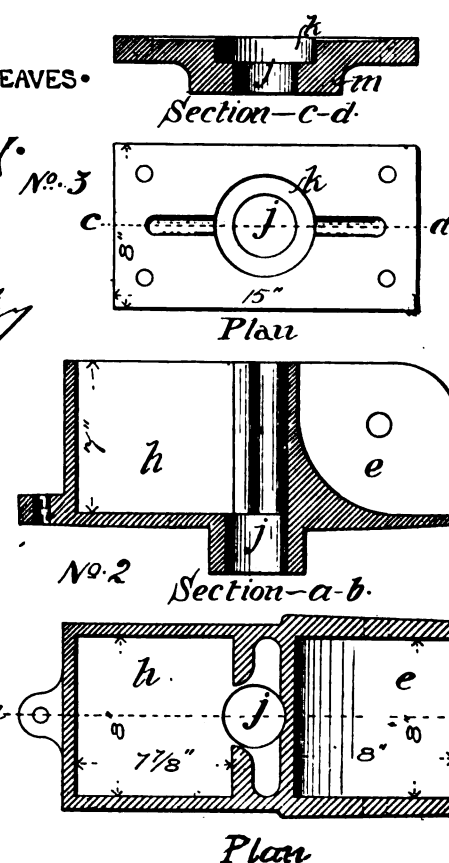
PAVEMENTS AND STREET RAILROADS.

No. XIV.

(Continued from page 379.)

WOOD PAVEMENT IN THE METROPOLIS.*

Durability.—One of the most important factors in connection with durability is the amount of traffic to which the pavement is subjected. As the author has been unable to obtain complete information thereon he has had to rest content with the available figures, and has reluctantly omitted results and comparison of other important streets. Table III. (see page 434) shows (1) the daily traffic weight per yard width; (2) the depth of annual wear of wood; and (3) the annual wear of wood as reduced to a standard of traffic equal to 750 tons per yard width daily, or 235,000 tons per annum, exclusive of Sundays. It is gratifying to



length on the bottom, to be fitted into supporting timbers. This projection has a hollow centre at *j*, corresponding with opening in pivot. This plate is bolted to timbers to prevent any movement when derrick is revolved. The pivot rests and revolves in socket *h*, which is $1\frac{1}{4}$ inches in depth and 5 inches in diameter. A groove is shown at centre of plate, which can be used when the pivot requires lubricating.

The rope is run from first sheave above foot of mast, through this pivot, passing around lower sheave and thence to the hoist-engine.

The rope that controls height of boom can also be passed through this pivot, if desired, and operated with steam-power by fitting double sheaves below the mast.

The advantages claimed for this device are the arrangement of hollow seats, indicated by *e* and *h*, for supporting the mast and boom in connection with a socket plate, with pivot between mast and boom, thereby transferring centre of gravity from centre of mast to a point where the two will nearly balance each other, and permit a derrick to be revolved with facility in any position, having only a minimum change in position of rope, which is worthy of consideration, particularly when wire rope is used.

The arc of contact being longer in the sheaves described than in ordinary size in use, the utility of the large sheaves is more apparent for wire rope than with manilla.

remark that there is a growing tendency to make observations and keep records of traffic weight, wear, and cost, and it is only by these means that reliable data can be obtained. It is to be hoped, therefore, that both local authorities and wood-pavement companies will institute the desired inquiries, by which means much valuable experience and knowledge will be gained. The comparative annual wear reveals several inconsistencies. For instance, the wear of the asphaltic pavement in Fleet Street with the maximum traffic weight, or 24th on the list, is but 16th in point of wear, whereas the same system with the 13th and 9th traffic weight positions, takes the high places of 24th and 23d in wear. Lloyd's pavement in Regent Street has an 8th traffic-weight position, but a 20th in wear. The wear of the improved, of Henson's, and of the plain pitch-pine pavements compares favorably in all cases with the traffic weight. The lesson to be drawn from these figures would appear to be that the asphaltic and Lloyd's systems are not successful; and the author cannot help regretting that Regent Street should have been paved upon these particular systems. The pavement in Parliament Street is stated to have worn $\frac{1}{2}$ inch only in three and a quarter years, but it must not be forgotten that its real wear has scarcely begun, and that the traffic weight is high. Should its life be eight years (which is extremely doubtful), it would take a higher position, as the annual cost would probably be 1s. 6d. per square yard.

It is interesting to notice that some pavements have exhibited a considerable degree of durability and have had

*A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

a tolerably fair life. In the author's table the pavements and periods under the headings "actual" life relate to accomplished facts, while several under the heading "estimated" have already nearly realized the life allotted to them. In other cases the estimate is given after inspection and measurement or inquiry. The number of the pavements is necessarily restricted in consequence of the absence of traffic-weight records.

III.—Comparative Wear of Wood Pavements as Reduced to a Traffic Standard.

SITUATION.	SYSTEM.	Weight per yard width per day of sixteen hours.		Depth of annual wear of wood.	Comparative annual wear of wood as reduced to a traffic standard of 750 tons per yard width per diem.
		Tons.	Inch.		
*Fleet Street.....	Asphaltic.....	1,360	0.456	0.251	
Ludgate Hill.....	Improved.....	1,236	0.428	0.259	
*Oxford Street.....	Henson's (east section).....	1,191	0.191	0.120	
*Fleet Street.....	Henson's.....	1,165	0.250	0.173	
*Oxford Street.....	Plain.....	1,164	0.475	0.306	
*Oxford Street.....	Asphaltic.....	1,137	0.484	0.319	
*Parliament Street.....	Improved.....	1,106	0.154	0.104	
*Leadenhall Street.....	Henson's.....	1,000	0.264	0.198	
*Oxford Street.....	Henson's (west section).....	985	0.390	0.250	
*Oxford Street.....	Henson's (central section).....	948	0.323	0.255	
*Leadenhall Street.....	Improved.....	808	0.200	0.186	
Brompton Road.....	Asphaltic.....	648	0.373	0.431	
King's Road.....	Improved.....	603	0.157	0.195	
Brompton Road.....	Henson's.....	584	0.184	0.236	
*Edgware Road.....	Plain.....	584	0.108	0.254	
*Regent Street.....	Asphaltic.....	556	0.280	0.384	
*Regent Street.....	Lloyd's.....	558	0.214	0.288	
King's Road.....	Improved (pitch pine).....	558	0.080	0.119	
King's Road.....	Plain.....	551	0.144	0.196	
King's Road.....	Plain (asphalt bed).....	498	0.139	0.209	
King's Road.....	Plain (pitch pine).....	468	0.055	0.088	
King's Road.....	Cresoted blocks (mastic joint).....	434	0.139	0.240	
King's Road.....	Cresoted blocks (lime joint).....	407	0.111	0.204	
Sloane Street.....	Plain.....	270	0.065	0.175	

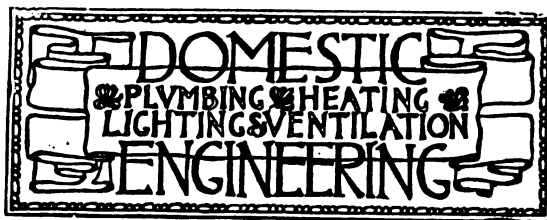
*Weight of traffic taken from Mr. Howarth's paper in these instances.

The author inclines to the opinion that it is not desirable to lay blocks of a greater depth than will provide for a life of seven years, as very few pavements retain a good surface after about six years' wear. In the case of the pavements previously described which have attained a greater life than seven years, it is proper to explain that those periods were only insured by the execution of frequent and somewhat costly repairs. For instance, a considerable number of new blocks, of depths varying from 3 inches to 5 inches, according to the extent of wear, had to be inserted in most cases, while in others the old blocks were taken up, reversed, and relaid. These operations, however, are very unsatisfactory, both in appearance and ultimate result. Experience consequently suggests that if 5-inch blocks were adopted instead of 6-inch, it would be preferable; and the author favors the opinion that the smaller depth would be found not only sufficient, but more economical and suitable, and would obviate much patching. Five-inch blocks are cheaper by 10s. per thousand, and it is estimated that in the first cost and twice renewal of a pavement which has an annual traffic of 750 tons per yard width, there would be a reduction in cost of 1s. 6d. per square yard in fifteen years, or 1 1/4d. per square yard per annum. Even if the average annual wear of 6-inch blocks should prove to be very little, after seven years' wear it will generally be found that the surface is irregular; but considerable hesitation is always shown before local authorities order the wood to be renewed, for fear that they may be accused of waste or extravagance in removing blocks which still retain a good depth, although they show a considerably worn and bumpy surface. In short, therefore, 5-inch blocks would give as good a surface and pavement as 6-inch blocks; there would be less waste of timber in renewal, and on the whole there is little doubt that pavements would be kept in a better condition. Blocks having a depth of 5 inches only have been laid in Oxford Street, Leadenhall Street, and Aldersgate Street, and in Kensington a large area has been laid on this system; and the result so far appears to be satisfactory.

The author has obtained numerous specimens of blocks from various streets, and he submits nearly sixty, which have been taken from Regent Street, Pall Mall, Cannon Street, Oxford Street, Ludgate Hill, Brompton Road, Praed Street, Sloane Street, King's Road, and Fulham Road. It will be observed that the maximum depth of wood is from King's Road (pitch pine), which is 5 3/4 inches after four and a half years' wear, and that the minimum is from Oxford Street (near Rathbone Place), which is 1 3/4 inches after six years' wear.

(TO BE CONTINUED.)

A GRANITE shaft recently quarried by the Bodwell granite Company in Vinalhaven is the largest piece of stone ever quarried on earth, and if erected will be the highest, largest, and heaviest single piece of stone now standing or that ever stood, so far as there is any record. It considerably exceeds in length any of the Egyptian obelisks. The shaft is 115 feet long, 10 feet square at the base, and weighs 850 tons.—Rockland (Me.) Opinion.



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. XI.

(Continued from page 409.)

FLOW OF WATER THROUGH MAINS OF AN APPARATUS.

(1.) To find the total head when the quantity of water to be passed and the size and length of pipe is given.

From the foregoing tables and what has been said about friction and resistance in pipes and fittings it is not a very difficult matter to determine the amount of head required for any particular set of mains, when the quantity of water passing and the size and length of the pipes are known, as we have simply to refer to the tables.

Say we have a line of straight and level 4-inch pipe, 100 feet long (no provision made for easy entry), passing 50 gallons of water per minute, from the side of a tank or boiler, what will be the total head required? By Table III. the head for friction of 4-inch pipe passing 50 gallons of water is .243 of an inch for 10 feet of length, and for 100 feet it is .243 × 10 = 2.43 inches. Then by Table II. it will be found that 1/2 inch of water-head will be required to move 51.94 gallons of water through a 4-inch pipe without considering the head for friction, which gives us a total of 2.43 inches for friction, plus .5 inches for velocity, = 2.93 as the total head necessary to move 50 gallons of water through a 4-inch pipe 100 feet long. In other and fewer words, the head for friction is directly as the length of the pipe in 10-foot lengths (according to the tables here given), and the head for velocity is a constant, irrespective of length.

If we now put one common elbow into this pipe, such as shown in Fig. 22, we will proceed as in the example given above, but instead of considering the length of the pipe as 100 feet, we will consider it 100 feet + 100 diameters for elbow; which will be 400 inches, or 33.3 feet, making the resistance equal to what it would be in feet 133.3 of straight pipe. Then we will have .243' × 13.33 + .5' = 3.74' total head required.

If we had five elbows in a run of 100 feet of pipe, then our problem would be 100' of 4" pipe + 500 diameters (or 166.5') = 266.5'. Then .243' × 26.65 + .5' = 6.97 as the total head required for passing 50 U. S. gallons per minute. Of course when the elbows are better than the common, as explained under "Loss of Head by Elbows or Bends," then fewer diameters must be considered and added as the value of the elbows.

By the above simple means we can always determine the amount of head necessary to produce a certain result in pipes that have been already run. In other words, should we go into a building that had been already piped, or should we have the plans of a job before us, with the lengths and sizes marked, and wished to know if the diameters of the pipes were ample or not for a given velocity and quantity, we would proceed as above and determine the total head; when it would be manifest whether the pipes were greater or less than they should be.

(2.) To find the quantity of water that will pass in U. S. gallons when we know the total head at our disposal and the length and the diameter of our pipe.

This is one of the most important points to a designer of hot-water apparatus. Where the total head at our disposal is known we are at a loss to know how much of the head is required to overcome the friction and how much is left to produce motion in the water. This does not admit of a direct solution, but we can take advantage of the fact that the discharge by any pipe or series of pipes and fittings is proportional to the square root of their heads (and that conversely the head is proportional to the square of the discharge), and therefore all we have to do is to assume a discharge for our pipe, and after having found the head necessary for the assumed discharge (as in 1) apply the above rule thus:

Assumed discharge × by square root of required head ÷ by square root of assumed head.

Thus, say, we want to find the number of U. S. gallons that will pass through a 4-inch pipe 100 feet long under one inch of total head; we will commence by assum-

say, 50 gallons, and already by (1) we have found that 50 gallons required a total head of 2.95 inches of water, which we will take now as our assumed head; therefore we have quantity looked for —

$$50 \text{ gallons} \times \sqrt{1'} \\ \sqrt{2.95}$$

which is equalled by

$$\frac{50 \times 1}{1.70} = 29.4 \text{ U. S. gallons}$$

as the quantity that will pass under one inch of total head through a 4-inch pipe 100 feet long.*

Having now found the quantity of water that will pass through 100 feet of 4-inch pipe under a one-inch head, it is important, also, that we should be able to establish the diameter of a pipe of the same length and under the same head that will discharge some other desirable or fixed quantity of water.

First we found the total head for an assumed quantity, the length and diameter being known (1). Then we found the actual quantity that would pass through the same pipe under the smaller head of one inch (2), and now we want to establish a new diameter—the length remaining the same—that will pass, say, 50 gallons, as at first assumed (1), but to pass it with only one inch of head (2).

This can be done by taking advantage of the fact that the diameters of pipes vary directly as the fifth root of the square of their discharges, head and length remaining the same; in other words, the diameters of pipes are proportional to the $\sqrt[5]{\text{discharge}}$.

(3.) Thus our third problem is:

To find the diameter a pipe should be for a given discharge under equal heads with another pipe, whose length, diameter, and discharge is known.

In our last problem (2) we found that 29.4 U. S. gallons would pass through 100 feet of 4-inch straight pipe under a total head of one inch. Let us now see how large a pipe of the same length it will take to pass 50 U. S. gallons under one inch total head.

The sum, according to the rule given, resolves itself into a simple proportion thus:

The fifth root of the square of 29.4 gallons . . . a diameter . . . the fifth root of the square of 50 gallons . . . × inches
of 29.4 gallons . . . of 4 inches . . . of 50 gallons . . .

— the new diameter in inches. Or the following simple formula:

$$\frac{\sqrt[5]{\text{gallons. inches.}}}{50.0 \times 4} = 4.9 \text{ inches.}$$

the new diameter.

It probably is not plain to many practical men how this answer is obtained, so we will endeavor to go over it in a simpler manner.

When the discharges from pipes are in the ratios of 1, 2, 3, 4, 5, 6, etc., the diameters will be in the ratio of 1., 1.32, 1.55, 1.74, 1.90, 2.05, etc.

These ratios of the diameters may be picked out of Trautwine's tables of Fifth Roots and Fifth Powers by squaring the discharges and substituting the answers thus found for the "Power" in the tables; opposite to which is the Number or Root that is the ratio of the diameter.

In our case, then, we have 29.4 and 50 gallons respectively that we must first square and then find the fifth roots of the respective squares. To get the fifth root of the square of either of these numbers will take us far beyond the limit of the tables of reference cited heretofore, but we may (without much error) use some common divisor, such as 10, and reduce the discharges to 3 and 5 respectively and then proceed as above. Thus 3 squared = 9, the fifth root of which is 1.55. Then 5 squared = 25, the fifth root of which is 1.9.

Then 1.55 : 4 :: 1.9 : X'

$$\begin{array}{r} 1.9 \\ 1.55 \overline{) 7.60} \quad 4.9 \text{ inches.} \\ \underline{6.20} \\ 1.400 \\ \underline{1.395} \\ 5 \end{array}$$

*Those who do not wish to work out the square roots of numbers can find tables in Trautwine's or Haswell's Pocket-Books that give the desired information.

†As it is a difficult thing to extract the fifth root of a number, and as practical men rarely wish to go into abstract calculations, I will refer them to Trautwine's Engineering Pocket-Book, where they will find tables of fifth roots and fifth powers that will obviate tedious calculations and, presumably, avoid clerical errors.

Thus the diameter sought is very nearly five inches, and as there is no 4.9 merchantable pipe the nearest practical size larger (5-inch) should be used.

(4) To find the discharge by pipes of different diameter, the head and length being the same.

This is necessary for the engineer when he has found the capacity of one set of pipes and wishes to know the capacity of another set, either larger or smaller in diameter but with the same head and length.

The rule for this is, that the discharges from pipes of equal lengths and heads is in the ratio of the 2.5 power of the diameter or the converse of the foregoing (3). The symbol "2.5 power" means the square root of the fifth power of a number as here written.

For the reason given before to practical men, a table of the 2.5 powers of numbers can be used much more readily than to attempt to find the root and raise it to its fifth power, therefore I refer the reader to Trautwine's tables again in this matter and by a study of the same it will show that with diameters in the ratio of 1, 2, 3, 4, 5, 6, etc., the ratio of discharge will be 1., 5.65, 15.59, 32., 55.9, 88.18, and so on.

Let us, then, proceed to find the discharge by 100 feet of 6-inch pipe under a 1-inch head; the discharge by a 4-inch pipe of the same length and head being 29.4 gallons. This is simple proportion again, so long as we have the ratio the discharge bears to the diameter, and this can be taken from the tables of the "Square Root of Fifth Powers" before mentioned, or the above ratios may be used as far as they go. Thus:

2.5 power of known diameter : known discharge :: 2.5 power of required diameter : (X) discharge —
(in this case) 4" : 29.4 gallons :: 6" : (X). Then substituting the ratio for the diameters we have:

Ratio. Gallons. Ratio.
32 : 29.4 :: 80 : X
80.0

32)2350.(73.45 + gallons

224

110

96

140

122

180

150

30

or nearly 73½ U. S. gallons that will pass through a 6-inch pipe 100 feet long under one inch of head.

(TO BE CONTINUED.)

ENGLISH PLUMBING PRACTICE.

BY A JOURNEYMAN PLUMBER.

(Conclusion of article LXVII. on page 380, September 3.)

HOT WATER FITTINGS (CONTINUED).

HOT-WATER cylinders are made of galvanized-iron plate varying from about .094 to .25 of an inch, or of sheet copper of about .035 to .120 of an inch in thickness. In some cases the copper cylinders are tinned inside.

The shape of the iron cylinders is generally as shown in sectional elevation Fig. 5. The sketch shows the posi-

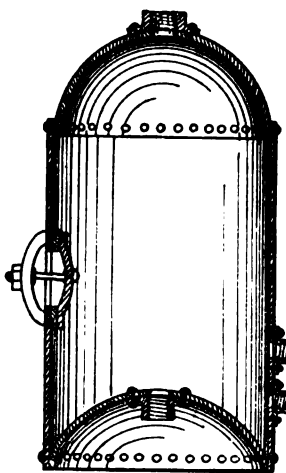


FIG. 5

tion of the manholes and connecting bosses, and speaks for itself. The bottom is domed upwards, as shown, as being more convenient for riveting, and also because if a

flat bottom is put on the pressure of water is found to make the bottom bulge downwards, so that the cylinder will not stand firm on a flat shelf or platform. Copper cylinders are sometimes made with the bottom domed downwards, and, instead of being riveted up the seams, are brazed together. When made this way, and the cylinder is to stand upright, a hollowed seating or bracket must be made for the bottom to rest in.

Some copper cylinders have the straight seams dovetailed and brazed, and the domical ends soft-soldered on, but as after a time the soldering comes away from the copper it is necessary to solder, or sweat, as it is sometimes called, an outer ring of copper over the soldered seam as an extra precaution against a leakage or breaking asunder of the domes and the body of the cylinder.

Figure 6 is an elevation showing the copper cylinder as described, and with a piece broken out so as to show the section of the joints referred to.

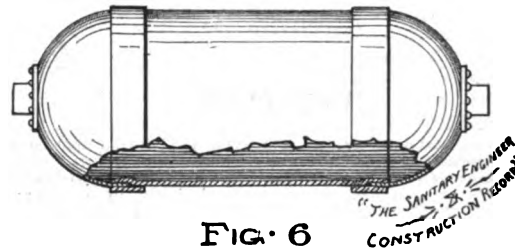


FIG. 6

The round cylinders are generally made with bridged manholes, as described for the boilers, for access to the inside for cleansing, etc.

Cylinders, as a rule, should stand above the level of the boiler, and should not be fixed on wooden shelves or brackets, but should have iron stands or brackets. Brick bases are sometimes built to support the cylinders, but the brackets are best, as more room is left for access for making the connections or giving any attention to them that may be necessary.

No. LXVIII.

CYLINDERS AND HOT-WATER CIRCULATION.

HOT-WATER cylinders should always be inclosed so as to avoid unnecessary waste of heat by radiation. They may be fixed in an inclosed recess, or covered with a non-conducting material such as "fossil meal," and other similar preparations.

A wooden casing may be fitted round them, with a space left between to be afterwards filled with a suitable material.

Dry hair-felt has been much used for this purpose, but the writer has recently had to take away all the felt that

For ordinary use "slag-wool" has been found very efficient to prevent radiation of heat from cylinders and is free from the objections referred to above, but it is necessary to have an outside covering. As the cylinder is usually fixed in the kitchen, anything unsightly should be avoided. For first-class work nothing looks smarter than a polished mahogany lagging, with bright polished brass bands or hoops to hold it together, and if the hoops are tightened up with screws the whole inclosure can easily be taken to pieces, should it be necessary to do anything to the cylinder or the connections.

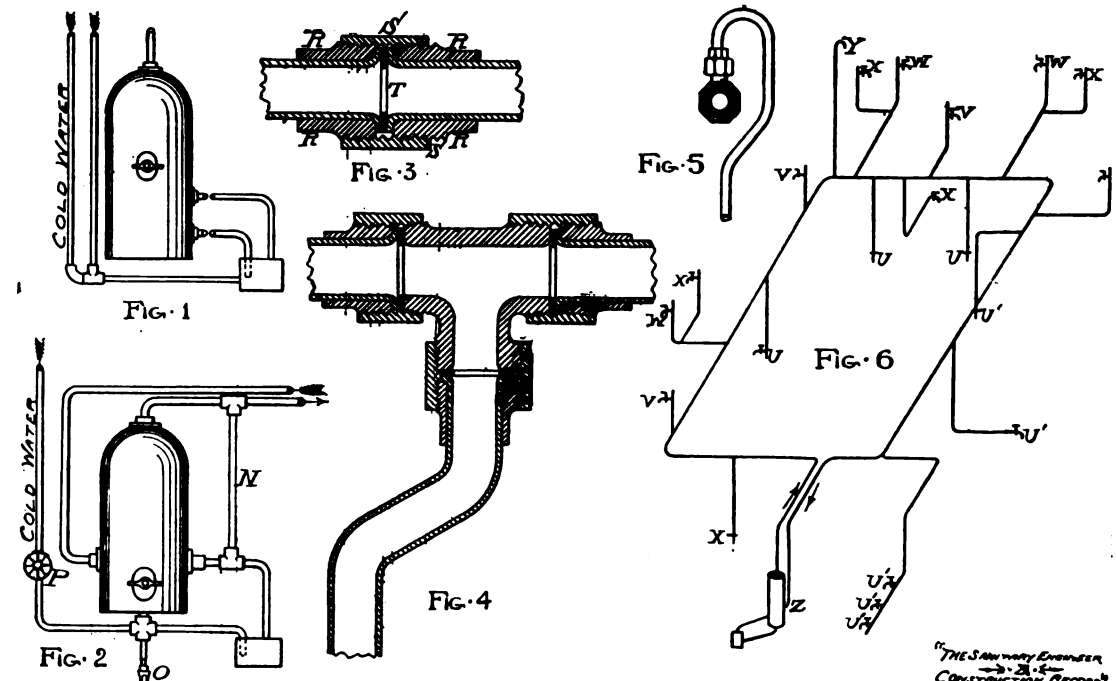
I think I have read somewhere in THE SANITARY ENGINEER AND CONSTRUCTION RECORD that in New York it is the practice to supply the hot-water system direct from the public water-main. This must be a very dangerous practice. Although the writer has no experience of this kind, still he cannot help thinking that there is danger of the boiler bursting, besides the annoyance of being without hot water should the mains break down or be emptied for repairs to them or any branch connections; or the pressure from the mains would be seriously reduced should all the water be required to supply the engines when a fire broke out in the neighborhood. In the writer's practice he always advises that the water be laid on from the main to a cistern or cisterns, which will hold at least enough for twelve hours' consumption.

We will now return to the question of hot-water circulation.

The pipes between the boiler and cylinder should never be less than 1¼-inch in diameter, but 1½-inch is much better. Or, if smaller pipes are used, the connections themselves to the boiler should be of the sizes stated, as it is not at all uncommon to find the ends in the boiler partly filled with fur, and especially where very hard waters are used. The cylinder may be fixed in any convenient position, but it is usual and best to fix it as near the boiler as possible.

Figure 1 represents a very good way for connecting the pipes, and a great many men fix them so.

Figure 2 is another way much practiced. In this figure the cold-water service-pipe is connected with the return-pipe to the boiler, for the reason that it has been thought not advisable for cold water to enter the boiler to replace the hot water that has passed away into the system of pipes. By connecting it with the return-pipe a certain quantity of warm water from the cylinder mixes with the cold, thus not submitting the iron boiler to sudden expansions and contractions. In Fig. 1 the cold water is shown as passing directly into the boiler. In Fig. 1 the manhole is shown as usually fixed, and in Fig. 2 it is shown near the bottom of the cylinder, so that any mud or sediment can be more easily removed. In Fig. 2 the pipes from the cylinder are shown as running horizontally. It is



was placed round some hot-water pipes, as moths were found to propagate in that material. In the case referred to the moths propagated to an extent that would appear almost incredible, and then spread into the woolen furniture of a house and had played sad havoc, some being almost entirely ruined and spoilt. In another case fleas were found to an unpleasant extent, and the hair-felt had to be removed because it was found to harbor them.

found in practice that the water will not circulate so freely in horizontal as in vertical pipes. In cases similar to the one quoted it has been found necessary to fix the pipe N from the boiler flow to the cylinder flow-pipe, so as to accelerate the circulation in the cylinder-pipes. It may here be mentioned that no draw-off cocks should be fixed or connected to the boiler or cylinder, but should be branched into the flow-pipe from the cylinder. The

reason for this is, that should the cold-water supply be exhausted or cut off for any purpose, it would not be possible to empty the boiler, etc., for reasons it is not necessary to repeat. A special cock should be fixed for the plumber to empty the cylinder when necessary for cleaning out or making any repairs. This cock should have a square head, or else be locked up so that servants could not tamper with it or make use of it. This cock is shown at O, Fig. 2. In some instances a pipe is connected with this cock so as to discharge the contents of the cylinder into a drain or waste-pipe. This is not a good plan, as the cock may be left open so that the water can run to waste and not be noticed. It is much better to fix a bibb cock as shown, so that the water can be drawn into pails. This gives a little more trouble to the plumber, but as it has to be done only once or twice in a year, the trouble is not worth considering. A stop-cock should always be fixed in the cold-supply-pipe as shown at P, Fig. 2, so that in case of accident the water can be shut off at once instead of the person in charge having to run to the top of the house, or wherever the cold tank is fixed, to shut off the supply. No expansion-pipe is shown in the figures, as it is usual to fix that from the highest point of the circulating-pipes.

The circulating-pipes from the cylinder should never be less than 1-inch diameter; $1\frac{1}{4}$ -inch is better, and for large mansions the writer has used $1\frac{1}{2}$ -inch pipes. In addition to iron, galvanized iron and copper pipes, as described in an earlier paper, lead, and lead-encased tin pipes have been used for hot-water pipes. Lead pipes have now fallen into disuse; indeed, the writer has not fixed any lead circulation-pipes for this last fourteen years. Hot and cold water passing alternately through lead pipes causes them to expand and contract to such an extent as to cause the pipes to break, and this occurs more when the pipes are too firmly fixed. Branch pipes frequently break near the joint to the main pipes. On looking closely at the ends of the fractured pipes the lead looks as if its particles were disintegrated, and there is no doubt that it is the want of tenacity in the metal that will not bear a tensile strain when shrinking that is the cause of the pipe being pulled asunder. The writer has used lead-encased tin pipe for hot-water work, and will not readily forget his first job. The great difficulty was to make the joints. A plumber's wiped-joint was found to melt the inside lining of tin, leaving a thin shell of lead, the tin melting and running into a mass in the bottom of the inside of the joint. Blow-pipe and copper bit-joints were tried and found to be failures. Next was tried a lining of pasted brown paper inside the joints. This answered fairly well, but the paper was found to wash off, and several pieces would congregate in some bend or branch-joint and cause a stoppage. The ends of the pipe were packed with whiting, but that was not a success. Tinned sheet-iron nipples inside the pipe ends were fairly successful, but it was found that gun-metal coupling-unions were the best means for connecting the pipes.

Figure 3 is a section of a joint made as described. The pipe ends were passed through gun-metal linings and tafted or flanged over. These linings had hexagonal ends at R R, and spanners were used for screwing them into the socket S. T is an asbestos or Indian-rubber washer, but if the flanged ends of the pipe are properly done and left with a smooth face, they can be butted together and screwed up so as to be water-tight without any washers. These joints require periodical examination and further screwing up, especially when the pipes are in long straight lengths. Horizontal pipes should always lie on wooden fillets fixed to the wall. If fixed on hooks the pipe will bag down between the fixings. The wooden fillet should be rather wide. Although it does not add to the appearance of the work, it is best not to have the pipes too straight so that they will have a direct strain on the screwed coupling connections, but any bends in horizontal pipes must lay flat on the fillet, or air will accumulate in any high parts. When pipes are quite straight the joints leak by the alternate pull and thrust motion which is continually taking place at each change of temperature of the water inside them. It is often lost sight of, but a fact nevertheless, that hot-water pipes when in use are *always in motion* and cannot be said to be still for more than a few seconds at a time.

Great care should be taken when making branch connections for draw-off pipes. Figure 4 is a section showing the T-union used for a branch pipe. It is a good plan not to have the branch pipe quite straight, but to bend it as shown, so as to allow for a slight motion of both the main and branch pipes, and thus render the liability of a

strain on the joint to a minimum. In some cases the writer has fixed the branch joint upwards as shown at Fig. 5, so as to allow for the motion predescribed.

Figure 6 is a bird's-eye view of a cylinder and the circulating pipes fixed to a nobleman's mansion in the country (England). The whole of the pipes were lead-encased tin. U U were draw offs to sinks on the ground floor. V V were similar draw-offs on the first or chamber floor. W W were baths. X X were wash-hand basins, and Y was the expansion-pipe. This was placed at the highest point of the circulating-pipe. Doorways and similar obstacles compelled this to be fixed where shown. The return-pipe was taken back and branched into the cylinder as shown at Z. This no doubt caused a slight check on the circulation of the water, but it was deemed advisable to make the connection as shown. It was thought that by reason of the long length of pipe and the consequent friction of the water passing through that any water drawn at the cocks U' U' would most likely be cold instead of hot if it had been connected in the usual way.

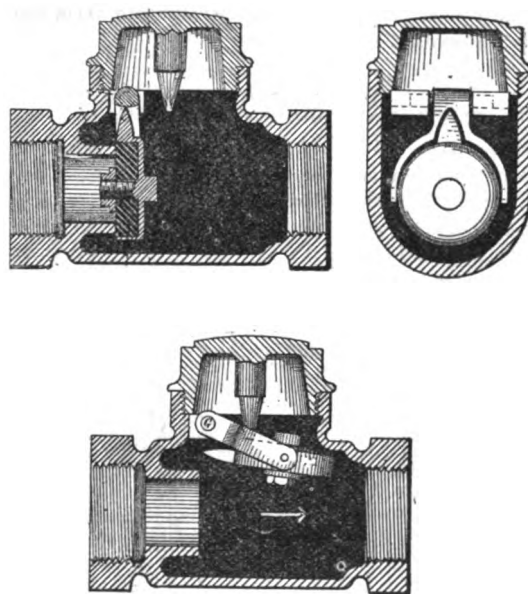
(TO BE CONTINUED.)

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

SWINGING CHECK-VALVE.

THE accompanying cuts show a novel swinging check-valve lately patented by James P. Neary, of Bridgeport, Conn. It has for its object to provide a device that will give an absolutely straight waterway that is withal simple



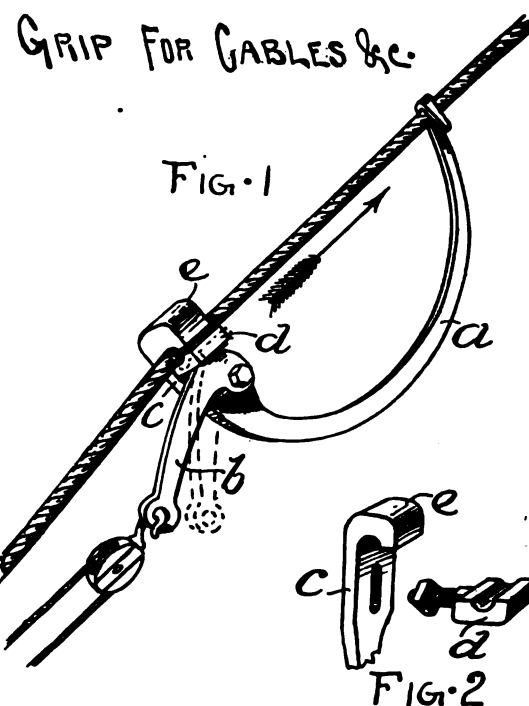
in construction and arrangement, and which shall seat automatically and tightly, irrespective of any wear which may occur either to the packing of the disk or to the seat, and consists in a valve casing and seat, which projects within the casing in the direction of the flow, and having a swinging disk suspended between the arms of a swinging yoke, with a projecting prong on the top of the disk, which engages with a similar projection within the cap or "nut" of the valve, when the valve or disk is forced from its seat by the passage of the water turning the disk and holding it in the plane of the current.

GRIP FOR CABLES.

THIS device is an improved form of grip for tightening derrick cables or guys. Figure 1 is perspective view, with the parts represented in full lines as they appear when in position to grip the cable, the dotted lines indicating position of lever-arm *b* when sliding jaw *d* is released from the cable.

The parts indicated by *a*, *c*, and *e* are made of a solid piece of wrought iron. Figure 2 shows a slot in head-plate *c* in which the movable jaw *d* slides freely. The lever-arm *b* has a curved face, and therefore will force jaw *d* to grip the cable in proportion to power applied.

To use this device a cable is inserted in the jaws *d e*, and hook of guide-arm *a* placed over cable. The tackle or other power is then applied to lever arm *b* and drawn taut, which will force the movable jaw *d* to grip the cable. If proper tension has not been imparted to the



cable on first trial it can be made fast, the grip released, and moved along the cable in the direction of the arrow to a new position, when the operation can be repeated.

This device was invented by Patrick Kelly, of Poughkeepsie, and is made by John Claffy, 48 Dey Street, New York.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A MAN TO PUT DOWN IRON SCREW-PILES.

IN response for request for a good man to put down "iron screw-piles," we have received the following:

Union Bridge Company recommend J. W. Hoes, Columbia County, N. Y., as having done a good job of that character for them in South America.

T. P. Kingsley, of Amherst, Mass., had charge of such work at Coney Island, N. Y.

Cofrode & Evans, of Pottstown, Pa., suggest D. R. S. Cofrode, 31 Montgomery Street, Jersey City; Robert Gibson, 331 Walnut Street, Philadelphia.

SWITCH-VALVE MANUFACTURERS.

BALTIMORE, September 12, 1887.

SIR: In response to the inquiry of "Switch-Valves" in your issue of the 10th inst., you can refer your inquirer to us, as we are the manufacturers of these articles.

BARTLETT, HAYWARD & Co.

CELLAR FLOODING FROM SUB-SOIL DRAINS IN SAME TRENCH WITH PIPE-SEWERS.

NEW YORK, September 7, 1887.

SIR: Some instances have come to my notice of cellar-flooding on line of small pipe-sewer, where sub-soil drains were laid in the same trench to carry off ground-water with sub-soil pipe laterals connecting with cellar-drains. It is supposed that during heavy rains the sub-soil pipes reversed their intended action, and becoming surcharged and under pressure, found relief by backing up through the laterals, flooding the cellars. Do you know of any similar instances at Memphis, Norfolk, or elsewhere?

Yours truly, W.

[We should be glad to hear from our readers in these cities.]

WESTERN ASSOCIATION OF ARCHITECTS.

LA FAYETTE, IND., September 10, 1887.

GENTLEMEN: At the last annual convention of the Western Association of Architects Article 10 was added to the by-laws, which reads as follows:

Article 10, By-Laws.—"All names of candidates are to be presented to the Board of Directors, and by them sent

to all members of the association thirty days before the meeting of the convention."

The requirements of article 10 are imperative—that all applications for membership must be filed with the Secretary on or before October 15, 1887. Members of all committees are earnestly requested by the Board of Directors to file their final report with the Secretary on or before October 15, 1887.

The last called meeting of the Board of Directors for the transaction of general business preceding the November convention will be held in Chicago October 18, 1887.

JAMES F. ALEXANDER,
Secretary Western Association of Architects.

BOOKS ON SCHOOL ARCHITECTURE WANTED.

LINDSAY, ONT., September 8, 1887.

SIR: Can you obtain for me a book entitled, "United States Work on School Architecture," or where it is published, and the price?

Also the same question as to report on "City Schools in the United States," by Dr. J. D. Philbrick.

Both the above works are quoted by our "Educational Department," and I should like to get them. If you can kindly give me the information asked for above, you will greatly oblige your subscriber to THE SANITARY ENGINEER AND CONSTRUCTION RECORD. WM. DUFFUS,

Lindsay, Ont., Box 407.

[Referred to our readers.]

HAVE STREET-SCRAPINGS BEEN PROFITABLY EMPLOYED AS A FERTILIZER?

NEW HAVEN, CONN., September 5, 1887.

SIR: In THE SANITARY ENGINEER AND CONSTRUCTION RECORD of May 14 last, page 633, you advise that "ordinary street-scrappings * * * should be used for fertilizing," etc.

I hoped to see some response to this, but seeing none, I write to ask that you collect and publish information on this point.

This seems the natural use to put street-scrappings to, but what success has attended such use?

For some years I have been on the lookout for cases where street-scrappings have been proved to have any agricultural value as a manure, and thus far I do not find any such cases where the stuff has practically any value.

I have heard, in a general and indifferent way, of places where they have been so used, where once on the ground they were disposed of harmlessly and perhaps did some good, but not enough to pay for the carting, or for any other material expense to get them on the land.

Several persons have told me of their experience in the attempted use of the street-scrappings of this city (New Haven, Conn.), and not one has told me that he has found them of any manurial value—that is, enough to pay for any trouble in getting them. On the other hand, several have claimed that the scrappings from our Telford pavements have proved actually injurious when applied to grass.

Here, as elsewhere, it is a problem what to do with the stuff. Our street-scrappings are too foul to be used for filling (although so used), and too clean to be of value for manure. I would like to know what the experience of other places has been. Yours respectfully,

WILLIAM H. BREWER.

[We shall be glad to publish the experience of any of our readers with the problem referred to by Professor Brewer. Our own does not enable us to recall any instance where it has been found profitable to use street-scrappings as a fertilizer.—ED.]

THE CENTENARY OF STEAM.

(From the New York Times.)

An American Inventor Unhonored at Home—Oliver Evans, who Patented, Built, and Worked the First High-Pressure Steam-Engine.

To the Editor of the New York Times:

OF all the inventions of ancient or modern times none have more importantly and beneficently influenced the affairs of mankind than the double-acting high-pressure steam-engine, the locomotive, the steam-railway system, and the steamboat, all of which inventions are of American origin. The first three are directly and the last indirectly associated with a patent that was granted by the State of Maryland in 1787, being the very year of the framing of the Constitution of the United States. In view of the momentous nature of the services which these four inventions have rendered to the material and national interests of the people of the United States it is to be hoped that neither they nor their origin will be forgotten in the coming celebration of the centennial of the framing of the Constitution.

The high-pressure steam-engine in its stationary form is almost ubiquitous in America. In all great iron and steel works, in all factories, in all plants for lighting cities with electricity—in brief, wherever in the United States great power in compact form is wanted, there will be found the high-pressure steam-engine furnishing all the power that is required, and more, too, if more is demanded, because it appears to be equal to every human requisition. But go beyond America. Go to Great Britain, and the American steam-engine—although it is not termed American in Great Britain—will be found fast superseding the

English engine—in other words, James Watt's condensing engine. It is the same the world over. On all the earth there is not a steam-locomotive that could turn a wheel but for the fact that, in common with every locomotive from the earliest introduction of that invention, it is simply the American steam-engine put on wheels, and it was first put on wheels by its American inventor, Oliver Evans, being the same Oliver Evans to whom the State of Maryland granted the before-mentioned patent of 1787.

He is the same Oliver Evans whom Elijah Galloway, the British writer on the steam-engine, compared with James Watt as to the authorship of the locomotive, or rather "steam-carriage," as the locomotive was in those days termed. After showing the unfitness of Mr. Watt's low-pressure steam-engine for locomotive purposes, Mr. Galloway, more than fifty years ago, wrote: "We have made these remarks in this place in order to set at rest the title of Mr. Watt to the invention of steam-carriages. And, taking for our rule that the party who first attempted them in practice by mechanical arrangements of his own is entitled to the reputation of being their inventor, Mr. Oliver Evans, of America, appears to us to be the person to whom that honor is due." He is the same Oliver Evans whom the *Mechanics' Magazine* of London, the leading journal of its kind at that period, had in mind when, in its number of September, 1830, it published the official report of the competitive trial between the steam-carriages Rocket, San Paniel, Novelty, and others on the Liverpool and Manchester Railway. In that trial the company's engines developed about fifteen miles in an hour and spurts of still higher speed. The *Magazine* points to the results of the trial and then, under the heading of "The First Projector of Steam-Traveling," it declares that all that had been accomplished had been anticipated and its feasibility practically exemplified over a quarter of a century before by Oliver Evans, an American citizen. The *Magazine* showed that many years before the trial Mr. Evans had offered to furnish steam-carriages that, on level railways, should run at the rate of 300 miles in a day, or he would not ask pay therefor. The writer will state that this offer by Mr. Evans was made in November, 1812, at which date not a British steam-carriage had yet accomplished seven miles in an hour.

In 1809 Mr. Evans endeavored to establish a steam railway both for freight and passenger traffic between New York and Philadelphia, offering to invest \$500 per mile in the enterprise. At the date of his effort there was not a railway in the world over ten miles long, nor does there appear to have been another human being who up to that date had entertained even the thought of a steam-railway for passenger and freight traffic. In view of all this, is it at all surprising that the British *Mechanics' Magazine* declared Oliver Evans, an American, to be the first projector of steam-railway traveling? In 1804 Mr. Evans made a most noteworthy demonstration, his object being to practically exemplify that locomotion could be imparted by his high-pressure steam-engine to both carriages and boats, and the reader will see that the date of the demonstration was three years before Fulton moved a boat by means of Watt's low-pressure steam-engine. The machine used involved the original double-acting high-pressure steam-engine, the original steam-locomotive, and the original high-pressure steamboat. The whole mass weighed over twenty tons. Notwithstanding there was no railway, except a temporary one laid over a slough in the path, Mr. Evans's engine moved this great weight with ease from the south-east corner of Ninth and Market Streets, in the city of Philadelphia, 1 1/4 miles to the River Schuylkill. There the machine was launched into the river, and the land-wheels being taken off and a paddle-wheel attached to the stern and connected with the engine, the now steamboat sped away down the river until it emptied into the Delaware, whence it turned upward until it reached Philadelphia. Although this strange craft was square both at bow and stern it nevertheless passed all the up-bound ships and other sailing vessels in the river, the wind being to them ahead. The writer repeats that this thorough demonstration by Oliver Evans of the possibility of navigation by steam was made three years before Fulton. But for more than a quarter of a century prior to this demonstration Mr. Evans had time and again asserted that vessels could be thus navigated. He did not contend with John Fitch, but, on the contrary, tried to aid him, and advised him to use other means than oars to propel his boat. But Mr. Fitch was wedded to his own methods. In 1805 Mr. Evans published a book on the steam-engine, mainly devoted to his form thereof. In this book he gives directions how to propel boats by means of his engine against the current of the Mississippi. Prior to this publication he associated himself with some citizens of Kentucky—one of whom was the grandfather of the present General Chauncey McKeever, United States Army—the purpose being to build a steamboat to run on the Mississippi. The boat was actually built in Kentucky and floated to New Orleans. The engine was actually built in Philadelphia by Mr. Evans and sent to New Orleans, but before the engine arrived out the boat was destroyed by fire or hurricane. The engine was then put to sawing timber, and it operated so successfully that Mr. Stackhouse, the engineer who went out with it, reported on his return from the South that for the 13 months prior to his leaving the engine had been constantly at work, not having lost a single day.

The reader can thus see the high stage of efficiency which Oliver Evans had imparted to his engine full 80 years ago. On this point Dr. Ernst Alban, the German writer on the steam-engine, when speaking of the high-

pressure steam-engine, writes: "Indeed, to such perfection did he (Evans) bring it, that Trevithick and Vivian, who came after him, followed but clumsily in his wake, and do not deserve the title of either inventors or improvers of the high-pressure engine which the English are so anxious to award to them. * * * When it is considered under what unfavorable circumstances Oliver Evans worked his merit must be much enhanced; and all attempts made to lessen his fame only show that he is neither understood nor equalled by his detractors."

The writer has already shown that there are bright exceptions to this general charge brought by Dr. Alban against British writers, but the overwhelming mass of them have acted more like envious children than like men when speaking of the authorship of the double-acting high-pressure steam-engine, the locomotive, and the steam-railway system. Speaking of this class of British writers, Professor Renwick, when alluding to their treatment of Oliver Evans, writes: "Conflicting national pride comes in aid of individual jealousy, and the writers of one nation often claim for their own vain and efficient projectors the honors due to the successful enterprise of a foreigner." Many of these writers totally ignore the very existence of Oliver Evans, and all of them attribute to Trevithick and Vivian the authorship of the high-pressure steam-engine and the locomotive. Yet, when doing so, all of them substantially acknowledge the American origin of both inventions, because it is morally certain that Trevithick and Vivian got possession of the plans and specifications of his engine. Oliver Evans sent them to England in 1794-5 by Mr. Joseph Stacy Sampson, of Boston, with the hope that some British engineer would approve and conjointly with him take out patents for the inventions. Mr. Sampson died in England, but not until he had extensively exhibited Mr. Evans's plans, apparently, however, without success. After Mr. Sampson's death Trevithick and Vivian took out a patent for a high-pressure steam-engine. This could happen and yet the invention be original with them. But they introduced into Cornwall a form of boiler hitherto unknown in Great Britain—namely, the cylindrical flue boiler—which Oliver Evans had invented and used in America years before the names of Trevithick and Vivian were associated with the steam-engine. Hence, they were charged over 50 years ago with having stolen the invention of Mr. Evans, and the charge has never been refuted. Hence, when British writers ignore the just claims of Oliver Evans, and assert for Trevithick and Vivian the authorship of the high-pressure steam-engine and the locomotive, they thereby substantially acknowledge the American origin of both inventions. They are not only of American origin, but their author, although born in 1755, was, nevertheless, an American of the second generation, seeing that he was descended from the Rev. Dr. Evans Evans, who in the early days of the colony of Pennsylvania came out to take charge of the Episcopal Church in Pennsylvania.

The writer has thus shown that with the patent granted by the State of Maryland to Oliver Evans in 1787 were associated, first, the double-acting high-pressure steam-engine, which to-day is the standard steam-engine of the world; second, the locomotive, that is in world-wide use; third, the steam-railway system which pervades the world; fourth, the high-pressure steamboat, which term embraces all the great ocean steamships that are actuated by the compound steam-engine, as well as all the steamships on the Mississippi and its branches.

The time and opportunity has now arrived to assert before all the world, gathered at the coming celebration of the centennial of the Constitution, the American origin of these universally beneficent inventions. Such a demonstration should be made, if only for the instruction of the rising generation. Not a school-book has fallen into the hands of the writer that correctly sets forth the origin of the subject-matter of this paper. He apprehends that it is the same with the books used in colleges and universities, for otherwise how could that parody on the history of the locomotive, called "The Life of George Stephenson, Railway Engineer," by Samuel Smiles, have met such unbounded success? To the amazement of the writer, a learned professor in one of the most important institutions of learning in the country did, in a lecture, quote Smiles as authority on a point bearing on the history of the locomotive! It is true that he made amends by adding, when his lecture was published, a counter-statement; but that such a man should have seriously cited such a work shows the widespread mischief done among people not versed in engineering lore by the admirably written romance of Smiles, who, as Edward C. Knight in his *Mechanical Dictionary* truly declares, has "pettifogged the whole case." If, as Professor Renwick intimates, "conflicting national pride" has led the major part of British writers to suppress the truth as to the origin of the high-pressure steam-engine, the locomotive, and the steam-railway system, surely true national pride should induce the countrymen of Oliver Evans to assert it. In closing this paper, the writer will say, for the information of the so-called "practical" men of the country, or, in other words, those men whose judgment of an invention is mainly guided by its money value, that Poor's Manual of Railroads in the United States for 1886 puts their capital stock and their debts at over \$8,162,000,000. The value of the steamships and steamboats actuated by the high-pressure steam-engine the writer has no means of ascertaining. Neither can he appraise the factories and other plants in the United States—to say nothing of the rest of the world—in which the high-pressure steam-engine forms the motive power.

AN AMERICAN CITIZEN.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
September 10.....	23.95	22.04	22.91	28.42	27.41	23.89	29.85

E. G. LOVE, Ph.D., Gas Examiner.

THE *Progressive Age* illustrates several forms of the Lowe incandescent gas-light. These consist of a filament, in the shape of a horse-shoe, suspended over an ordinary flat-flame burner. To the inner side of this filament is attached what appears to be a many-fluted wire. The material composing these burners is stated to be "four or five of the rare indestructible metals." The smallest size burner is said to give a ten-candle light, while the larger size will give a twenty-candle light, "by the use of no other agent than plain fuel, water-gas," etc. Our contemporary says that two years' practice has shown that there is no deterioration in the metal itself, and if a filament should become injured it can be exchanged at a cost of five cents.

THE Electrical Exhibition of the American Institute will be held in this city from September 28 to December 3. The exhibits will be divided into six sections as follows: (1) Production of Electricity; (2) Apparatus Requiring Powerful Currents; (3) Apparatus Requiring Comparatively Weak Currents; (4) Electric Conductors; (5) Electrical Measuring Apparatus; (6) Historical and Miscellaneous Exhibits.

THE *Electrician* gives the following account of the arrangements which have been made by the British and Continental Gas Association for lighting the Vienna Opera-House by electricity: The dynamos are of the Crompton vertical type, with double horse-shoe magnets, and give an output of 120 amperes at 600 volts. They are employed to charge in series five sets of batteries which discharge over independent circuits. The lighting of the stage is controlled by a special switch connected with both arc and incandescent lamps inclosed in globes of various colors, and the combinations are so arranged as to give the effects of daylight, dawn, sunset, the furious blaze of a conflagration, or pale silvery moonlight. It is anticipated that these effects will surpass anything of the kind hitherto attempted. To avoid any unnecessary disturbance of the walls, which are very handsomely decorated, it was found possible to make use, to a considerable extent, of the gas-pipes as channels for the wiring.

THE following points of interest to electricians are taken from the *Gastekniker's* report on the lecture by Fr. Ross before the Austrian Elektro-technischen Verein on "Electric-Light and Power Plants in the United States." There are 426 central stations in the United States for electric-lighting, a few of which furnish power. They supply 80,000 arc, and 300,000 incandescent lights. To do this they expend 150,000 horse-power. The numerous lights run from isolated plants are not included in the above. Water-power is seldom used. The length of wires necessary is 550 kilometres on poles, and about 50 kilometres underground. Towers are very generally used for city lighting, and with great success. These towers range from 38 to 76 feet in height, and stand 240 to 850 feet apart. Mr. Ross speaks specially of Detroit, where he says they would require 12,000 gas-lamps to light the surface now illuminated by 122 towers, this surface being double that of Vienna. There are about 100 kilometres of electric railroads in this country. Electric motive power furnished from stations is very much cheaper here than in Europe.

Mr. W. J. DIBDIN has presented to the Metropolitan Board of Works (London), the results of his elaborate tests of various photometric standards. The work included 2,120 tests, or over 20,000 observations. Speaking of the proposed standards, Mr. Dibdin says:

"In selecting a substitute for the present legal candle, care should be exercised to insure that it complies with the three main conditions which apply to the present standard—viz.: 1. That it should have a definite combustible material. 2. That the condition in which that com-

bustible material exists at the time of use should be under control and capable of inspection for verification. 3. That the rate of combustion, and the manner in which it is effected, should be readily and accurately observed. By applying these considerations to each of the proposed standards, a guide is at once obtained for the selection of the most suitable. The pentane air-gas, as devised by Mr. A. Vernon Harcourt, the Keates lamp, and the amyl-acetate flame of Herr von Hefner-Altenneck, all answer to the requirements of these conditions; while the Methven screen, the pentane lamp, the ten-candle test, and its improved form, which I have called the 'Pentane Argand,' although each giving most excellent results in practice, fail to comply with these requirements, as they each depend upon a purely arbitrary rate of consumption of combustible material, coupled with a definite height of flame, but no check is afforded by means of which an involuntary error in the setting of the flame by the observer can be afterwards detected. Of those proposals answering to the above conditions, the Keates sperm-oil lamp has one serious defect—in that the wick, when once used, cannot be reignited without fresh adjustment or renewing, and thus a discrepancy is apt to occur. Furthermore, the practical difficulty found by various operators in obtaining a flame of uniform character seems to have been more serious than I had hitherto been led to suspect; and to such an extent has this been experienced that I am compelled to put it on one side in face of the more easily managed pentane air-gas and other proposed substitutes for candles. The amyl-acetate lamp has many points which entitle it to very careful consideration, not the least among these being its extreme simplicity and portability. It is, in fact, only a carefully constructed spirit-lamp; and in actual work has given most admirable results. Unfortunately, however, the color of the flame is its one weak point; and for this reason I am of opinion that it is not the most suitable for adoption as the standard. On the other hand, I have found the pentane air-gas to comply with every demand made upon it, and to answer to the full all the claims made for it by the inventor."

The "Pentane Argand" mentioned above consists of the Sugg 10-candle test supplied with pentane air-gas. In conclusion the report recommends that the "committee do advise the board to forthwith take such action as may be necessary to secure the adoption, with as little delay as possible, of the pentane air-gas standard as devised by Mr. A. G. Vernon Harcourt, F. R. S., etc., as the legal standard of light in this country. As, however, many practical photometrists are of opinion that a standard of light of more than one candle is desirable for many purposes, I further recommend that when the legal substitution of the pentane unit for the present candle be made, the Board of Trade should be empowered to sanction and authorize the use of such other standards and substitutes as that board may deem fit and proper to be used in place of and after comparison with the pentane air-gas flame."

A LARGE SYPHON.

A SYPHON of considerable interest has recently been constructed at the Fritzer Works, near Saurvik, in Norway. These works include a number of mills run by water-power from Farris Lake, the water being retained by a dam built 120 years ago. The height of fall utilized is 36 feet, and the supply of water required is 550 cubic feet per second. This supply could not be obtained through the sluices when the water sunk below a certain level, and it was determined to draw the water from a greater depth. The sluices could not be lowered, and the use of two siphons was therefore decided on which should draw water from four feet below the bottom of the sluices. These siphons are 82 feet long, and 5 feet 2 inches in diameter, and are made of riveted $\frac{1}{4}$ -inch steel plates. They have a suction height of 3 feet 11 inches, and are opened and closed by a ring sluice worked by one man. The air-pump acts on both siphons, and four men can pump the air out of them in ten minutes. The mouth-pieces are of cast-iron, and rest in 12-inch timbers covered with 3-inch boarding. The cost of the siphons was 40,000 kroner, and they are giving great satisfaction.—*Engineering*.

SEWAGE PURIFICATION AT ACTON.

THE sewage-works at Acton, near London, were opened the other day. The sewage from the high-level district runs into the water by gravitation; that from the low-level is pumped by two 35-horse-power engines into the channel leading to the tanks, where it is mixed with chemicals and then run into tanks to allow all solid matter to settle. The purification is effected by a combined process of precipitation and filtration, a special feature being the absence of lime in the ingredients used for this purpose. The material used for precipitation is the magnetic ferrous carbon and compound sewage salts supplied by the International Purification Company. After precipitation in the tanks, the surface liquid is passed through a filter-bed composed of granulated magnetic spongy carbon and sand; the purified effluent passes by a culvert

into the River Thames, a quarter of a mile distant. The sludge left at the bottom of the precipitation-tanks is then pumped up and forced through Drake & Muirhead's sludge-presses; the solid cake which is thus formed is then ground up for manure. It is claimed for this process that ninety per cent of the soluble organic matter is removed from the sewage, and that the effluent has not the deleterious effect upon a river of an effluent from a lime process.

A USEFUL MAN IN A CITY ENGINEER'S OFFICE.

(From the *Milwaukee Evening Wisconsin*.)

ALMOST everybody has a plan for abating the river nuisance, but it is not everybody that attempts to turn his plan to personal account. One such case, which occurred the other day, deserves recording. A man entered City Engineer Benzenberg's office and informed that official that he had a cheap plan for getting rid of the foul river-water. Encouraged to unfold his plan, he proceeded with the air of a man who is doing another a great favor to tell Mr. Benzenberg to "dig a few artesian wells above the dam and turn their flow into the river."

"How many do you think it would take?" asked the engineer, somewhat doubtful of the efficacy of the scheme.

"Not many. An ordinary well flows 24,000,000 gallons a day, and I should think four or five would do."

"The biggest well in this country," replied the engineer, "flows only 300,000 gallons a day, and it would take over a thousand of them to do the work."

"But they don't cost much," said the man, not to be downed.

"How much?"

"Perhaps \$2,000."

"Well, granted that one costs only \$2,000, and I think you would find its cost to be twice that amount, your project would cost \$2,000,000."

That staggered him, and he seemed greatly disappointed at the way his scheme had flattened out. He scratched his head thoughtfully for a moment and then said: "It don't look so cheap as it did, does it? But, say, can't you work me in a for a job somewhere around your department?"

BREAK IN RESERVOIR WALL AT ATLANTA.

A SMALL reservoir at Atlanta, Geo., comprising a portion of the system of water-works, broke away September 3 soon after having been filled with water. It occurred in that portion of the retaining-wall where the embankment had not been completed. The brick retaining-wall was intended to have ample strength to resist the pressure without the embankment. We are told a careful examination of the bricks has revealed a slight oily surface, which has been found to be due to the use of petroleum in the molds in manufacturing the bricks. It is claimed that this prevented a proper bond.

A PROPOSED ENGINEERS' CLUB IN NEW YORK.

A MOVEMENT has been inaugurated looking to the practicability of starting a social club for engineers, with a view to bringing the members of the several branches of the engineering profession into closer personal relations and afford a convenient headquarters for non-resident engineers during their visits to this city. It is proposed to call a meeting for organization as soon "as 250 eligible gentlemen in good standing as members of representative engineering societies have signified their willingness to join."

THE municipal authorities of Berlin have issued a series of instructions for the better protection of public buildings from lightning. The earth circuit from the rods must be copper cable not less than $\frac{1}{4}$ -inch diameter. Each rod must have a testing circuit and switch, insulated from the building and from earth and coming close to the ground, to obviate the need of climbing to the roof for testing purposes.

It frequently causes much trouble, indeed, in some cases, defies all efforts to free iron from ingrained rust, but, according to a German paper, the thorough cleansing of it may easily be effected by immersing the article in a nearly saturated solution of chloride of tin, even if much eaten into. The duration of the immersion will depend upon the thicker or thinner film of rust; in most cases, however, twelve to twenty-four hours will suffice. The solution of chloride of tin must not contain too great an excess of acid, otherwise it will attack the iron itself. After the articles have been removed from the bath, they should be first washed in water, and then with ammonia, and be dried as quickly as possible. Articles treated in this manner assume the appearance of dead silver.—*The Engineer*.

PERSONAL.

JOHN HENRY STEPHENS, architect, died at Closter, N. J., September 8, aged fifty-six years.

MR. WILLIAM N. CRAIGHILL, father of Colonel William P. Craighill, U. S. A., died last week in Charlestown, W. Va., in his eightieth year.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

THE EIGHTY-EIGHTH REGIMENT P. V. ASSOCIATION invites plans and proposals until October 6, for the erection of a monument on the Gettysburg Battlefield. Louis Wagner, Chairman, 419 Walnut Street, Philadelphia.

MADISON SQUARE GARDEN COMPETITION.—The Building Committee, on advice of Professor W. R. Ware, professional adviser of new building competition, have recommended the designs submitted by Messrs. McKim, Mead & White, of New York.

HARTFORD, CONN.—Plans for the railway depot were considered September 13 by the Committee of New York and New Haven Railroad, and all rejected. Messrs. Clark and Reed were appointed a committee to employ an architect to prepare plans under their direction. The cost is limited to \$150,000.

ALLEGHENY, PA.—The High School Committee has received four plans for the new building on Sherman Avenue: from Joseph Anglin, L. O. Danse, Thomas A. Boyd, and J. W. Alston. The cost will be about \$50,000. No decision is yet made.

PRIZE PLANS FOR DRAINAGE.

The New Orleans City Council has before it the following resolution, presented September 6:

"Resolved, That the Comptroller be authorized and is hereby instructed to advertise once a week for four weeks for plans and specifications for improving and cleaning the drainage-canal of the city, with estimate of cost of work, and that for the best plan submitted the sum of \$4,000 be paid out of the first available funds collected of the reserve of 1883 to 1887, inclusive, and that this Council shall select two civil engineers of this city who, together with the city surveyor, will decide upon the best plan submitted, upon their award the said \$4,000 to be paid."



For works for which proposals are requested see also the "Proposal Column," pages 421-425-427-428.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

NUNDA, N. Y.—Our correspondent writes in regard to the building of water-works here that they will be built by a private company and will be in operation by November 15.

GRAND JUNCTION, COL.—The City Council has in contemplation putting in water-works. One plan is the "gravity system," taking water from the mountains twenty miles away. The other is the "Holly system," taking water from the Grand River flowing past the town. An election is called to vote on the proposition for or against water-works on the 13th of the present month.

HOLMESBURG, PA.—The contract for the water-pipe has been awarded to the Warren Foundry and Machine Company, Philadelphia, N. J., and the stand-pipe to Samuel Farmer, Harrisburg Boiler-Works, Harrisburg.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs Improvement Water-Power Company has let a contract to Hiedelberg & Co., of Pleasanton, Kan., for a dam of stone across Spring River; price, \$18,000. J. M. Archer is Trustee for the Improvement Co.

MOBILE, ALA.—The works constructed by the Bienville Water-Works Co. (S. R. Bullock & Co., New York) were tested September 10 and found satisfactory. The cost was \$685,000. The works were constructed under direction of C. Delafield, Chief Engineer.

GALLIPOLIS, O.—The City Council has received from the Special Committee word that several water-works firms have been heard from, estimating the cost of works at \$50,000 to \$60,000. The matter will be voted on, at the city election, in November.

SUFFOLK, VA.—Our correspondent writes: "I am informed that the Portsmouth and Suffolk Water Company, of Portsmouth, Va., and the Suffolk Light and Water Company, of Suffolk, Va., are both anxious to make a contract with the town of Suffolk."

SACO, ME.—Incorporated are the Saco Water-Power Machine Shop; Clerk, Charles M. Moses, of Saco; Treasurer, Spencer W. Richardson, of Boston; and the Saco Water-Power Company; Clerk, Winfield S. Dennett, of Saco; Treasurer, George Dexter.

GREENVILLE, MICH.—Our correspondent writes in regard to the election on water-works: "The election has been postponed; think it will be held October 10."

CRETE, NEB.—Our correspondent writes that the opening of bids for constructing water-works has been extended to September 30.

WARR, MASS.—An agitation is started for a system of sewers.

SPRINGFIELD, ILL.—It is proposed to increase the water-supply by establishing filter-basins at the works. Peter Berriman is Superintendent of Water-Works.

WINCHESTER, CAL.—Incorporated is the Pleasant Valley Land and Water Company to operate principally at Winchester. The Directors are: William J. McEwen, William Hazlam, W. A. Lucas, J. H. Rice, J. Patterson, and Mrs. E. J. Rice, all of Winchester.

KAUKAUNA, WIS.—We have previously noted the progress of the movement for water-works here. Council has advanced the matter. Address the City Clerk.

CORPUS CHRISTI, TEX.—Our correspondent writes: "I have this day mailed to you a marked copy of the paper of our city, so you may see what action we have taken in regard to water-works. The committee is now awaiting bids for the work, which I think will be the boring of artesian wells. The Committee is J. Henry, George French, and O. C. Lovenskiold." The clipping reports a session of City Council August 30, at which the City Attorney read an opinion to the effect that the city had authority to establish a special tax for water-works and other improvements.

TOPEKA, KAN.—The Topeka Land and Water-Power Company was fully organized September 1. The following officers were elected: President, Colonel William Tweedale; Vice-President and Manager, Hon. S. K. Cross; Secretary, Colonel J. C. Douglass; Treasurer, Hon. H. E. Corwin. The purpose of this company is to develop the water-power of the Kansas River, damming it some twelve to fifteen miles above this city and bringing the water near here by a canal.

MARSHFIELD, WIS., will have sewers.

PORTSMOUTH, VA.—The water company has had an ordinance drawn, and submitted to City Council, relating to works.

BROOKLYN, O.—The State Infirmary Directors will build a sewer to the Cleveland line.

WEST STRATFORD, CONN.—There is difficulty about awarding the contract for the new sewers.

SAN DIEGO, CAL., will let contracts for 140,000 feet of sewer trenches. See our Proposals.

WHITESTONE, L. I.—It is proposed to obtain a supply of water from the College Point Company, and negotiations are going on.

MOUNT CARROLL, ILL.—At a special election held September 8 to bond the city five per cent. of assessment for the purpose of erecting water-works, the vote stood: For water-works, 271; against water-works, 58.

GALENA, ILL.—The Board of Aldermen of this city, September 9, adopted a resolution accepting the new artesian system of water-works just completed.

PETERSBURG, ILL., wants bids for constructing water-works. See our Proposals.

CHICAGO.—Incorporated is the Tulare Valley Improvement and Irrigation Company to irrigate and improve lands; capital, \$500,000. A. H. Pickering, H. A. Foster, Fowler B. Hill.

WATER-WORKS are in prospect at the following places: Farwell, Mich.; Ennis, Tex., artesian wells; Denton, Tex., artesian wells, address O. P. Roe; Cabery, Ill., cost \$30,000; Chambersburg, N. J.; Mount Vernon, Ill., bonds issued \$25,000.

PORTLAND, CONN.—Our correspondent writes: "I have to say that there will not be anything done about the water business until after the town meeting, October 3."

AUSTIN, ILL.—Our correspondent writes: "No official action has as yet been taken in the matter of erection or operating water-works."

YORKVILLE, S. C.—Our correspondent writes: "Have the water-works under consideration; do not think any steps will be taken at present to build them."

AMERICUS, GEO., Council Committee has rejected all the bids presented for the construction of water-works. The estimate was \$30,000, the lowest bid \$32,600. It is now reported that the city will employ a consulting engineer and build the works itself. Address the Mayor.

KROOK, IOWA.—George D. Rand has sold a controlling interest in the Keokuk Water-Works to the American Water-Works and Investment Company, of Pittsburg, Pa.

NORFOLK, NEB.—\$15,000 has been appropriated for sewerage and other work.

LANSINGBURG, N. Y.—In reference to previously reported increased supply of water, further information can be obtained from Commissioner Holmes, of the Water Board.

GAINESVILLE, TEX., will have a water-supply from artesian wells. Contractors Bell & Myers, of Denton.

OAKLAND, CAL.—The Spring Valley Water Company wants iron pipe for the mains which it will lay in Alameda County. Charles N. Fox is agent of the company in Oakland.

WILLIAMSBURG, IOWA, will provide water for fire protection, with a large tank or reservoir.

CHIHUAHUA, MEX.—Bids for constructing water-works are asked for until October 13. Address the Mayor, Don Juan Zubiran.

SHELL LAKE, WIS.—It is proposed to build water-works here.

KEARNEY, N. J.—We have already noted that this town will build water-works. Wade & Egan, contractors began work September 13, and expect to finish by October 31.

HAYWARD, WIS., will spend \$12,000 on its water-works.

BOSTON.—Much new sewer-work will be done under recommendations from the Mayor.

LONDON, ONT.—A proposition to raise \$150,000 for water-works purposes will be submitted by the City Council to a general election.

FLORENCE, WIS., will extend its water-works.

CHATTANOOGA, TENN.—We have already mentioned that much new sewer-work will be done toward establishing a general sewerage system. The Board of Public Works, in its recent report to the Mayor and Aldermen, estimates the length at about 34,000 feet, varying from 36-inch to 8-inch, the larger sizes of brick and the smaller of pipe. The cost is put at \$59,304.

TUSCOLA, IND.—On October 1 an election will be held on the question of raising \$26,500 for a system of water-works.

SOUTH PITTSBURG, PA.—Water-works will be built here. Address the South Pittsburg City Company.

NEW ORLEANS, LA.—Address the Superintendent of the New Orleans Water-Works about improvements to be made.

OWENSBORO, KY.—The water-works will be enlarged.

ANNISTON, ALA.—Address N. E. Moorehead about a large lake to be constructed here.

FORT WORTH, TEX.—O. M. Brown has the contract for enlarging the water-supply by sinking gang-wells.

SAUGERTIES, N. Y.—Under date of September 13, our correspondent writes: "Water-works are being constructed at this time, and will be completed in about two weeks."

EVANSTON, ILL.—The trustees have in consideration a plan for furnishing a supply of water for North Evanston. Address Trustee Grover, author of the plan.

TOPEKA, KAN.—Address Mr. Cross, President of the Water-Power Company, in regard to a project for damming Kansas River at Rossville. The dam will be about 800 feet long.

REYNOLTON BOROUGH, PA.—A committee has been appointed to ascertain the cost of providing a water-supply.

MYSTIC, CONN.—Water-works contractors should attend to this place at once. Prospectors are now on the ground looking over sources of supply for this town and Stonington.

ABERDEEN, DAK.—Our correspondent writes that no election was held on the question of constructing sewers.

GREENSBORO, N. C.—Owing to the illness of the chairman of the Water Commission, the contract for building water-works has not yet been awarded.

LAKE GENEVA, WIS., holds an election on the question of introducing water.

PORTLAND, ORE.—Incorporated is the Sunnyside Land and Improvement Company at this city. The capital stock of the company is \$100,000. The incorporators are: J. H. Smith, B. H. Bowman, and F. C. Goodin. The objects of the company include the right to construct roads, railroads, and street railroads to a point five miles east from Portland; also to equip and operate the same, build water, gas, and electric-light works, etc.

BROOKLYN, CONN.—Incorporated is the Ramapo Water Company, of this city, to supply Brooklyn and New York with water.

SPRINGFIELD, ILL.—The water-works will be enlarged. Address the City Engineer for further information.

JERSEYVILLE, ILL., will obtain a supply of water from artesian wells.

MARQUETTE, MICH.—A proposal will be found elsewhere for constructing certain parts of the main sewerage system of this city, after plans by Chester P. Davis, of Chicago, Consulting Engineer. The separate system will be used; about 1½ miles will be built.

DUBUQUE, IOWA.—For the sewerage-work here, already referred to, proposals are now issued, which will be found elsewhere in this issue. There will be about 10 miles of work, on the separate system, after plans by Chester B. Davis, of Chicago, who is the Consulting Engineer.

SAVANNAH, GEO.—Our correspondent writes: "The city of Savannah has just completed 13 artesian wells, as follows: 1 4-inch well, 1 10-inch well, and 10 6-inch wells. The flow from these is about 6,000,000 gallons every 24 hours. There is some talk of boring three wells more. The city does her own work in boring and fitting."

PHILADELPHIA.—\$25,000 will be spent for laying iron water-pipe to connect East Park Reservoir with the city mains.

NATCHEZ, MISS., has taken adverse action on the matter of constructing sewerage.

NORTHAMPTON, MASS.—The Aldermen have voted to adopt the "Shedd plan" of sewerage, which was proposed in 1882. The estimated cost is \$480,000 to complete the work. Address the City Engineer.

REED CITY, MICH., has decided to have a system of sewers constructed. Address the City Clerk at once.

CAMDEN, N. J.—The City Council of Camden, N. J., offers for sale a Cornish pumping-engine, 21 inches plunger, 41-inch cylinder, 7-foot stroke, built to lift 3,000,000 gallons in 24 hours. The pump is located at PAVONIA, N. J.

SANTA CRUZ, CAL., will expend \$60,000 for water-works, sewerage and other improvements.

SAN LUIS OBISPO, CAL., has in prospect the construction of water-works, sewerage, street-work, and parks.

FARGO, DAK.—Hon. Alexander McKenzie may be addressed about the water-works now building.

NEW HAVEN, CONN.—The City Engineer will advertise at once for bids on the Boulevard Sewer.

MONTELEONE, VT.—On September 26 a town meeting will be held to decide on increasing the water-supply by a new iron main.

PROVIDENCE, R. I., City Council has passed the following resolution: "That the City Engineer cause borings and soundings to be made on location of the main line of the sewers, pump works, and precipitation tanks, outfall, etc., and also prepare detailed plans of the various parts of the work necessary for carrying into effect the sewerage plan as adopted by the City Council, the expense of the same to be charged to the appropriation for sewers."

MILWAUKEE.—City Engineer Benzenberg has prepared plans for the flushing tunnel. It will be run 2,440 feet from the lake to the river in Dane Place. It will be of brick, twelve feet in diameter, and will cost \$100,000 exclusive of the pumping works, which will be located on the lake shore about opposite the Dalrymple farm. The entire sewer will be beneath the water line and the water will be lifted by the pumps three feet; 300,000,000 gallons of water per day will be pumped and 300 horse-power engines used. The Finance Committee of Council has decided to recommend \$25,000 for constructing the tunnel.

PORTSMOUTH, VA.—City Council has finally come to an agreement and entered into contract with the water company.

BARRE, VT.—The Barre Water Company, chartered by the last Legislature, has arranged with Goodhue & Birnie, of Springfield, Mass., to supply Barre Village with water by July 1, 1888. On completion of the works the town has the option of purchasing them within sixty days at an advance of 10 per cent. on their cost.

PLYMOUTH, MASS.—A town meeting was held September 12, with William T. Davis as Moderator. The warrant related to the adoption of an act of the Legislature permitting the town to provide a system of sewerage. A committee was appointed to report a bill at the next March meeting.

CORTLAND, N. Y.—Sewer contractors should observe events here. Sewerage wanted.

HAYWARD, WIS.—Our correspondent writes: "No particular steps have yet been taken in regard to the water-works, except that H. H. Harrison, of Stillwater, is drawing up the plan and specification for said water-works. The contract for putting it in will be let to lowest bidder."

HUDSON, WIS.—Our correspondent writes in regard to water-works: "Artesian well down about 150 feet, flow of water 150 gallons per minute; about one mile of pipe laid, and the work being pushed with vigor. Foundations are in for pumping station; nearly all material and appliances on the ground and expect to complete the work before winter. We expect a flow of 400 or 500 gallons per minute when complete of pure water. Appropriation of \$20,000 for the works. They probably will exceed that amount."

NICKERSON, KAN.—Mayor S. R. Marshall will receive bids until September 26 for constructing water-works.

MANKATO.—The City Council has awarded the contract for building a reservoir for the water-works to Adam Jefferson for \$4,550; 2,300 feet of pipe, to connect mains with the reservoir, were ordered purchased.

ST. PAUL.—Sewer on Colborne Street, from St. Clair to Superior, White & Adams, \$2,100; sewer on Colborne Street, from Seventh to Jefferson, Hans Hansen, \$1,760; sewer on Aurora Avenue, E. J. Kirkland, \$42,975.

LODI, CAL.—The directors of the Makelumne Ditch and Irrigation Company have decided to complete the dam on Makelumne River. Bids will be asked for very soon.

ROCHESTER, N. Y.—Common Council has employed Emil Kuichling, C. E., to make plans and specifications for the East Side sewer.

KAUKAUNA, WIS.—An engineer has been employed to make a report on water-works.

MARION, IOWA.—Our correspondent writes: "The city does not own or operate our water-works, but they are owned and controlled by a local company, who are now completing it by laying about three miles of additional pipe or mains."

FORT WAYNE, IND.—The Water Trustees have recommended that a contract be made with the Holly Manufacturing Company, of Lockport, N. Y., for a 6,000,000-gallon Gaskill pumping-engine; cost, \$27,650. The matter is referred to the Finance Committee of Council.

ST. IGNACE, MICH.—Address the Water Commissioners about proposed water-works here.

BOONE, IOWA, will have water-works.

FENTON, MICH.—C. W. Coe may be addressed about water-works.

GAS AND ELECTRIC-LIGHTING.

LAKE, ILL.—The Town Council is considering a proposal of the Economic Heat and Gas Company to furnish illuminating power of 125 candles for \$1.50 per 1,000 feet, heating gas at \$1.25 per 1,000 feet, and gas for public lamps at \$1.25 per 1,000 feet. President Sherwood stated that his company would light the street lamps at \$22.50 a lamp.

SAN ANTONIO, TEX.—The city has made a two years' contract with the San Antonio Gas Company to maintain 50 arc-lights at \$14.40 per month and 200 gas-lights at \$2 per month.

IOLA, KAN.—Natural-gas has been discovered here and a well sunk.

WHITESTONE, L. I.—The New Jersey Globe Gas-Light Company, of New York, has made an offer to erect 50 lamps and light them 22 nights each month for \$16.75 per lamp per annum. A contract will be made with the company.

SANDUSKY, O.—The City Council is considering the abolishing of gas and the introduction of electricity for street-lighting.

DETROIT, MICH.—The Edison Power and Light Company let a contract September 9 for the building of a water-power canal along the rapids of the St. Mary's River at Sault Ste. Marie. The canal will be about 2,000 feet long and 50 feet wide. Its object will be to furnish, by the use of great water-power, electric power with which to run elevators, mills, and an endless variety of other machinery and an electric-light plant.

SEWARD, NEB.—has decided to have electric-lights in the streets.

TAMPA, FLA.—The city has contracted with the Tampa Electric-Light Company to maintain arc-lights at 60 cents per lamp per night.

WEST BAY CITY, MICH.—City Council has awarded the contract for lighting the streets to the West Bay City Electric-Light Company at \$77 per lamp yearly.

ORANGE, N. J.—Articles of incorporation of the Edison Illuminating Co., of the Oranges, were recorded September 11. The incorporators are: Gilbert R. Hawes, Thomas A. Edison, Edward A. Pearson, Eugene S. Kaas, and Thomas Marsh. The object of the company is to furnish electricity for lighting, heat, and power in Orange, East, West, and South Orange.

MORRISTOWN, N. J.—The Common Council on September 12 opened bids for lighting the streets, as follows: The Morristown Gas-Light Company made three propositions, the first to furnish 4-foot burners twenty-six nights a month for \$22.50 a year. This is the same service that was given last year for \$26. The second proposition is for 6-foot burners for the same number of nights for \$27, and the third is for all night and every night in the year at \$27. The Electric-Light Company offered to furnish incandescent lights of 25-candle-power every dark hour for \$17.50 for each light a year, and arc-lights, not less than twelve in number, at \$10 each per month.

YOUNGSTOWN, O.—Just organized is the Home Gas and Fuel Company to lay gas-mains in the city.

WINCHENDON, MASS.—A town meeting is being held to-day to see if the Selectmen shall take action to secure electric-lights in the streets.

GAINESVILLE, FLA.—The Electric-Light Company has received a franchise for lighting the streets. Address W. J. Winegan.

BRYAN, O.—The Fountain City Oil and Gas Company, of Bryan, increases its stock from \$10,000 to \$100,000 for improvements.

UTICA, N. Y.—The certificate of incorporation of the Citizens' Mutual Heat, Light, and Power Company, of Utica, was filed in the Clerk's Office September 13. The object is the manufacture of electricity for light and power, and distributing fuel-gas, hot water, hot air, and steam. The trustees for the first year are: George D. Dimon, John B. Wild, Isaac R. Scott, John Caney, and William S. Doolittle. Work on the plant will be pushed.

BERKELEY, CAL.—The citizens have formed a company to establish an electric-light plant. Address R. P. Thomas, of the Standard Soap-Works, at once.

SPARTA, WIS.—A company is forming to establish an electric-light plant.

LOGAN, O.—Steps will be taken to provide the necessary plant to utilize the gas from the wells for heating and lighting.

LUDINGTON, MICH.—This city will introduce electric-lighting for the streets.

CEDAR RAPIDS, IOWA.—Articles of incorporation of the People's Light and Power Company, of Cedar Rapids, were filed September 9. The officers are: C. J. Ives, President; W. J. Greene, Secretary; and J. B. Bever, Treasurer. Electricity will furnish the basis.

JACKSON, MICH.—The ordinance relating to electric-lighting, which was vetoed by the Mayor, has been passed over the veto by City Council.

CALDWELL, KAN.—An electric plant will be established here for street-lighting.

TOPEKA, KAN.—The Brush Electric-Light Company has made a proposition to City Council for extra lighting.

NORFOLK, NEB.—An appropriation has been made for electric-lights for the streets.

ALGERS, LA.—An electric-light plant will be established here by the Louisiana Light and Power Company, of New Orleans.

BRAINARD, MINN.—will have electric lights. The plant has been purchased.

SUMTER, S. C.—On September 7 City Council discussed a proposition from the Maryland Electric Motor Manufacturing Company to light the streets with electric-lamps. No action was taken, but a contract will probably be made.

DUNDER, MICH.—Address J. S. Dixon, President of the local company, about plant for sinking oil and gas wells.

WATERVILLE, ME.—It is proposed that the town shall buy the plant and franchise of the Waterville Electric-Light Company. The price is put at \$30,000.

BELVIDERE, ILL.—Incorporated is the Belvidere Electric-Light Company: capital stock, \$8,000; incorporators, S. L. Coney, Frank W. Plane, Charles E. Fuller, and others.

ALLENTOWN, PA.—On September 20 Mayor W. K. Ruhe will open bids for lighting the streets with gas, electricity, naphtha and oil. At the same time bids for lamps and lamp-posts will be opened.

JAMESTOWN, DAK.—will introduce electric street lighting.

GREENBUSH, N. Y.—has contracted with the East Albany Gas Company to light the street-lamps and keep them in repair for \$2.75 per 1,000 cubic feet.

PALMER, MASS.—A gas company is to be formed here to supply both Palmer and Monson.

VIRGEN, ILL.—The Virgen Gas and Oil Company is just organized, to bore wells for oil and gas.

LAKE, ILL.—A franchise has been given to the Economic Heat and Light Company, for the laying of mains and furnishing of gas.

COLUMBUS, GEO.—City Council, September 13, awarded a contract to the Brush Electric-Light Company at \$108 per light per annum.

STEAM-HEATING, BUILDINGS, ETC.

WALDO, TENN.—\$40,000 will be expended on buildings and machinery for a cold-storage plant. Address Fred Balcom.

BRIDGES.

UPPER DARBY, PA.—The County Commissioners will build a bridge here.

HIGGINSVILLE, N. Y.—A bridge will be built by the County Commissioners.

JEFFERSONVILLE, KY.—A bridge will be built. Address Dennis Long.

OLD ORCHARD BEACH, ME.—It is proposed to build an iron pier here 1,300 feet long, 25 feet wide, with electric-lights, etc. Address Henry Staples, of the Old Orchard House.

SANTA FE, N. M.—Address the City Engineer, who has prepared plans for two additional bridges over the Galisteo and the Rio Grande.

NORRISTOWN, PA.—Bids are asked for a bridge over the Wissahickon.

NEWBERNE, N. C.—A bridge is wanted. Address at once the Clerk of the County Commissioners.

FRONT ROYAL, VA.—A bridge will be built. Address W. L. Garrison at once.

TOPEKA, KAN.—City Council has passed resolution directing the City Engineer to furnish plans and estimates for an iron bridge over the Kansas River on Kansas Avenue.

CAVE SPRING, GEO.—It is proposed to build a new bridge on Bridge Street. Address the County Engineer of Floyd County at the county seat in Cave Spring.

AUBURN, R. I.—Dean & Westbrook, of Brooklyn, N. Y., have received the contract for iron work of the bridge to be built over the Pawtuxet River, at Elmwood Avenue, and J. Dailey & Sons the contract for stone work. The bridge will be of iron, 140 feet long and 20 wide. The cost will be about \$10,000.

ALBANY, N. Y.—On September 13, Superintendent Shanahan, of Public Works, awarded contracts for bridges in Buffalo as follows: That at Austin Street to McLean & Rockwell, of Syracuse, for \$4,224.50, and that at Hudson Street to D. W. McConnell, of Buffalo, at \$6,663. There were four bidders for the Hudson and three for the Austin Street.

BROCKPORT, N. Y.—Another bridge will be built over the Erie Canal at Main Street. Proposals will be issued at once.

EAU CLAIRE, WIS.—At a special meeting of the Council, September 12, a resolution was adopted for the appropriation of \$6,120 for the construction of an iron bridge of two 100-foot spans across the Eau Claire River from Dewey Street. The contract for building the structure was awarded to Horace Houghton, of Rochester, Minn.

SIDNEY, NEB.—Cheyenne County is preparing to build three bridges over the Platte River; cost \$45,000.

FOND DU LAC, WIS.—The Aldermen have passed ordinances providing for the building of two bridges. Address the City Engineer.

POTTSVILLE, PA.—Bids for a bridge over Middle Creek are wanted. See our Proposals.

AUSTIN, TEX.—Address the County Commissioners in regard to a proposed iron bridge over Colorado River here.

FOND DU LAC, WIS.—In our Proposal Columns will be found a notice relating to an iron bridge over Fond du Lac River.

ROCKVILLE, CONN.—A new bridge is being built on the Connecticut River at West Street. Selectman Fitzgerald is doing the work.

SHAWNTOWN, EAU CLAIRE CO., WIS.—It is proposed to build a bridge over Half Moon Lake, to cost \$25,000. Address the Commissioners of Eau Claire County.

DETROIT, MICH.—Bids for building the Belle Isle Bridge were opened by the Board of Public Works, September 10, as follows: Keystone Bridge Company, \$375,630; George Farwell, Detroit, \$335,000; Detroit Bridge and Iron-Works, \$330,000; King's Iron Bridge Company, Cleveland, \$343,000; Morse Bridge Company, Youngstown, O., \$360,000; Milwaukee Bridge Company, four propositions, as follows: \$287,000, \$305,000, and two at \$295,000.

MANASQUAN, N. J.—At the meeting of the Board of Chosen Freeholders of Ocean County it decided to cooperate with the Monmouth County Board in building a new bridge across the Manasquan.

ALMY, WYO.—A new bridge is to be built over the Bear River here, on the Woodruff Road.

NEWARK, N. J.—The Improvement Association of the Eight Ward, Newark, are considering the desirability of building a new bridge across the Passaic at Third or Fourth Avenue.

NORTH EAST, MD.—An iron bridge will be built over Main Street. Address the County Commissioners.

BROOKLYN BRIDGE.—Look out for proposals for elaborate work at the terminals of the Brooklyn Bridge: plans by Engineer Shunk.

SAN FRANCISCO, CAL.—The Chief Engineer of the Harbor Commission is preparing plans for a pier 340 feet long and 100 feet wide.

BRIDGE.—The New York, New Haven, and Hartford Railroad has contracted with the Consolidated Bridge Company, of Pittsburg, for a bridge over the Connecticut River, at Lyons, to cost \$100,000.

BRIDGES.—The Port Jervis, Monticello, and New York Railroad will begin work at once, including the construction of a number of bridges, for which contracts will be given out. The president of the road is Henry R. Low.

CHICAGO.—Fitz Simmons & Connell are awarded, by the North Chicago Street Railroad Company, the contract to build the substructure for the new Dearborn Street bridge for \$30,000.

City Engineer Artingstall, of Chicago, by order of Mayor Roche, is figuring out the cost of a four-tracked steel bridge, turned by steam, at Madison Street and the Chicago River. A popular estimate is \$1,500,000, not including necessary land condemnations.

WOODLAND, CAL.—The Supervisors have contracted with the San Francisco Bridge Company to build a bridge over Cothe Creek to be 600 feet long; price, \$7,000.

NEW HAVEN, CONN.—The City Engineer will advertise at once for bids for constructing a stone arch bridge at Rock Lane. The estimated cost is \$20,000.

BRIDGES will be built as follows: The Atchison, Topeka, and Santa Fe Railroad Company will build a bridge at Lexington, Mo. George L. Sands, Topeka, Kan., General Superintendent.

The County Commissioners will build a bridge across the Oconee River, at Dublin, Geo. The Boston and Maine Railroad Company will build a bridge across the Merrimac River, at Newburyport, Mass. James T. Furber, Boston, General Manager. The Commissioners of Rome, Geo., will build a bridge over the Oostanula River at that city.

WALLULA, W. T.—A bridge will be built over the Columbia River at this place.

ST. PAUL.—The City Council has awarded the contract for constructing the Colorado Street bridge to O'Brien Bros. for \$26,895.

PITTSBURG, PA.—Josiah Speer, County Controller, will receive bids until September 21 for approaches to a bridge over Peter's Creek.

STREET WORK AND PAVING.

AKRON, O. wants bids, until September 24, for street-work.

SAN DIEGO, CAL.—The County election on the 5th, to decide the issuing of bonds for highway improvements, went in favor of raising the funds, and the work will be done.

NORFOLK, VA.—The Street Committee has decided to pave Granby Street with Belgian block, and an appropriation of \$30,000 will be made. Contracts will be made at once.

CINCINNATI, O.—Improvements will be made on Crawford Creek Road, for which proposals are wanted by the Board of Public Affairs.

STEAM stone-crusher and steam road-roller is wanted by Lancaster, Pa. Address bids, until October 3, to the Street Committee of Councils. Apply for further information to the City Clerk.

TRENTON, N. J.—Humboldt Street will be extended.

NEW LONDON, ONT.—On 3d October City Council will consider undertaking the enlargement of Water Street.

PITTSBURG, PA.—Much street-paving, sewerage, and opening is before City Council, and are likely to pass. The cost will be about \$40,000.

HARRISBURG, PA.—The city has contracted with the Barber Asphalt Paving Company to pave and curb Market Street, at \$2.75 per square of paving and \$1.50 per lineal foot for paving.

BETHLEHEM, PA.—The Street Committee of Council has just closed a contract with Farrell & Worsden for a stone-crusher, and will do a good deal of street-work at once.

LAKE VIEW, O.—Considerable street-paving has been ordered done by City Council. Address the Board of Public Works.

MILWAUKEE.—Bids will be received by the Board of Public Works to put in new stone curbing on Twelfth Street, from Grand Avenue to Cedar Street, about 1,600 feet of curbing; new sidewalks on First Street, from North Avenue to Lee Street, 600 feet; improving Eighth Street, from Locust to Burleigh Streets; improving Conway Street, from Kinnickinnic Avenue to Logan Avenue.

NEW HAVEN, CONN.—The Board of Public Works will soon take action on paving Temple Street with asphalt.

CLEVELAND, O.—Bids will be opened September 22 by Walter Rice, City Engineer, for Medina stone pavement on Case Avenue.

NORFOLK, VA.—\$15,000 has been appropriated to pave Holt Street with Belgian block, and \$30,000 to pave Granby Street with same material.

SOUTH FRAMINGHAM, MASS.—The town has voted to apply \$10,000 to repairing the road to Saxonville. Address S. B. Bird, Moderator.

FARGO, DAK.—The City Engineer has prepared plans and estimates for a subway under the Northern Pacific Railroad track at Broadway.

LANCASTER, PA.—Street contractors and paving material men should watch for result of discussion on the paving of some of the principal streets which is now going on in City Council.

OKLAND, CAL.—Filbert Street will be graded and paved.

CONY ISLAND, N. Y.—The Brooklyn Park Commission will have a sea-wall built at Brighton Beach, involving a considerable outlay.

GRAND RAPIDS, MICH.—Improvement of East Street let to Richard Pickett at \$16,000.

LANSINGBURG, N. Y.—Address the City Engineer in regard to bids on repaving certain streets, including Sixteenth and Seventeenth Streets.

HOLBROOK, MASS.—Considerable grading and street work will be done here, and town meeting September 9 voted to employ an engineer to make plans and estimates.

LAKE, ILL.—The Town Trustees have awarded a contract for improving State Street to Dollse & Shepard, at about \$45,000.

RAILROADS, CANALS, ETC.

NEW YORK CITY.—A proposal for the lowering of the tracks of the N. Y. C. R. R. in the 23d and 24th Wards has been made by the Park Commission to the Railroad, and a plan about agreed upon. It is estimated that the cost will be \$2,000,000, and that work will be soon begun.

MARION, IND.—The annual election of a board of nine directors for the Marion and Indianapolis Railroad was held August 19, resulting in the choice of the following: William Garver, of Noblesville; Eli Goodman, of Hackleman; J. W. Parsons, of Independence, and Cyrus W. Gibson, Moses Bradford, Marshall F. Fingley, James Brownlee, D. W. McKinney, and David Overmann, of Marion. The Marion and Indianapolis Railway was organized in January, 1881, to build a line from Marion to Indianapolis. The board of directors will meet here for organization, and to decide on a plan of action.

POUGHKEEPSIE, N. Y.—Articles of incorporation of the Poughkeepsie, Hartford, and New England Railway Company, which proposes to construct a line from Poughkeepsie to the Hartford and Connecticut Railroad, have been filed. The directors are: James W. Husted, of Peckskill; John I. Platt, Ezra White, and Peter Hulme, of Poughkeepsie; George W. Green, of Goshen; Henry Gay, of West Winsted; William Gibbs, of Philadelphia; Edward McNeill, of Hartford; Henry H. Boddy, Elverton R. Chapman, David J. McNiece, and William R. Carlisle, of New York, and Charles H. Swan, of Brooklyn.

ATLANTIC CITY, N. J.—The Cape May County garden farmers have for several years been supplying Atlantic City with fresh vegetables. The trip has been unusually slow, as only small boats could be used on account of there being no direct deep channel in the inland waters. With a view of securing quick transit with large boats the truckers have secured the services of a surveyor who is now looking into the possibility of a direct route.

ONEONTA, N. Y.—The Oneonta and Otsego Valley Railroad Company, to be operated from Otsego to Oneonta, distance 28 miles, has been incorporated. The directors are Sidney Dillon, Arthur W. Soper, William R. Thomas, New York.

PITTSBURG, PA.—The Electric Street Railway Company will increase its stock by \$75,000 to add to its plant.

FLUSHING, N. Y.—The Flushing and College Point Surface Railroad Company has decided to begin operations at once. The first work to be let will be the grading and laying of the rails. The cars of the company will be run by electricity, probably on the storage-battery plan. Joseph L. Dykes is President and Chairman of the Construction Committee; Henry Clement, Treasurer; Arthur Fleming, Secretary, and Joseph K. Murray, Counsel.

BEAVER, PA.—A dike will be built across the Ohio River at this place for the Pittsburg and Lake Erie Railroad. A. E. McKinsie, of Ashtabula, O., is the contractor.

PENSACOLA, FLA.—The Pensacola Gulf, Land and Development Company was organized September 6. The officers of the company are: J. C. Petterson, President; S. N. Vanpraag, Secretary; W. A. Delemberte, Treasurer.

QUINCY, ILL.—Incorporated is the Quincy and Rock Island Railroad Company, the principal office at Quincy, and the amount of capital stock to be \$2,000,000. The incorporators are Charles A. McLaughlin, of Galesburg; Sam S. Gray and Charles R. Arnold, of Hamilton; Charles H. Drere, of Moline; Morris Rosenfeld, of Rock Island; George W. Jretzinger, of Chicago; James M. Bishop, of Quincy; James T. Crawford and William Hill, of Warsaw, Ill.

MINNEAPOLIS, MINN.—Incorporated September 6 was the Continental Cable and Street Railway Company. The principal office is in Minneapolis. The capital stock is \$100,000, and the incorporators are Horace P. Breed and W. B. Tibbits, of Minneapolis; William S. Crosby, of Chicago.

NEW YORK CITY.—Plans for lowering N. Y. C. R. R. tracks in the 23d and 24th Wards will be on exhibition at the Park Department until October.

SACRAMENTO, CAL.—The City Trustees of Sacramento, at a meeting September 6, granted a franchise for two additional street railways, one to Alais & Lewis and the other to Frank N. Myers.

ASTORIA, ORE.—Address J. Q. A. Bonlby, President of the Chamber of Commerce, about a new railroad to be built to connect with the transcontinental lines; \$150,000 has been raised by the city as a bonus.

LEAVENWORTH, KAN.—City Council has granted the application of the Rapid Transit Railway for permission to build a line to the suburbs.

PHILADELPHIA.—The Pennsylvania Railroad will receive proposals for the grading of two additional tracks 2½ miles long on their New York Division from Cornwell to Schenks; also, for the erection of proposed "shops" at Camden, N. J., on the Amboy Division, consisting of erecting shops, paint shop, planing mill, and boiler room, all exclusive of foundations, plumbing, gas-fitting, asphalt floors, and boiler shop.

DULUTH, MINN.—The Duluth and Iron Range Railroad will be extended and connection made with the Canadian Pacific.

MOBILE, ALA.—Dredge men should observe the action of the directors of the Cotton Exchange in reference to deepening the harbor. The Secretary can give further information.

JEFFERSONVILLE, KY.—Articles of incorporation have been filed of the Jeffersonville and Ohio Falls Street Railway Company. The capital stock is fixed at \$40,000. The incorporators are G. W. Baxter, E. V. Stealey, Jacob S. Fry, Henry Burt, and James H. McCampbell.

HALIFAX, N. S.—Messrs. Thomas C. Connor and R. C. Donald, of Moncton, have been awarded the contract for rebuilding the railway wharf at Richmond, Halifax. The contract price is understood to be in the vicinity of \$50,000.

RAILROAD.—The contract for building the Tennessee and Mississippi Rivers Railroad has been let to D. S. McIntyre, of Corinth, Miss.

LAMAR, MO.—The Denver, Memphis and Atlantic Railroad will build into this city.

KNOXVILLE, TENN.—The charters of incorporation were filed September 12 for two new railroads. The charter members consists of A. A. Arthur, and others. The roads are Careyville, Jackboro, and Big Gap and the Jellico and the Cumberland Gap Road.

MILWAUKEE, WIS.—The Milwaukee City Railway will extend its tracks. The Milwaukee and Wauwatosa Cable Company has been granted a charter.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 17. } PUBLISHED EVERY SATURDAY.

NEW YORK, SEPTEMBER 24, 1887.
LONDON, OCTOBER 8, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.
Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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PECULIAR METHODS IN THE DISTRIBUTION OF THE NEW CROTON AQUEDUCT REPORTS.

FOR several years past American engineers having large engineering problems under consideration have visited Europe to personally inspect works and gather information impossible to obtain in published reports, in order that their clients, the different cities of the United States, might profit by the experience of communities on the other side of the water, and, so far as possible, be spared the expense involved in experimenting in unknown fields. Speaking for ourselves, as well as others with whom we are acquainted, we can truly say that, without exception, European engineers have taken unusual trouble to give us information, giving their time freely and affording every facility to engineers who have visited them properly accredited. They have done this entirely from a professional feeling that an engineer should give his fellow freely the benefit of his experience in matters of this sort. And more, they have frequently answered personal letters, giving valuable data without hope or expectation of any pecuniary reward. Had a title of this information been sought for by a city or a commission in charge of any public work, a handsome fee would have very properly been expected. So far as we know, no American community has ever paid a dollar for any information thus acquired. When European engineers, however, come to this country, our engineers will of course be glad to show similar attentions to them.

Yet up to this time in sanitary engineering our engineers' only opportunity of reciprocating has been by sending, with their personal compliments—not compliments of a commission—copies of their reports to the gentlemen who have afforded them facilities for obtaining valuable data. This is indeed our engineers' only method of indicating that courtesies received have not been forgotten.

When Rudolph Hering visited Europe to report upon the sewerage systems there, he was greatly indebted to a number of engineers, and yet when his report was published by the National Board of Health it was impossible for him to secure a single copy to send to the gentlemen to whom he was thus indebted. Such volumes as were published, however, found their way into the hands of people of supposed political influence or their friends, and the men who had most need for them could not get them for love or money. Some three weeks ago we noticed with approval the report of the Chief Engineer of the Aqueduct Commission on the progress of the work on the new Croton Aqueduct, commending the commissioners for placing before the profession a work containing this valuable data. This community have had in their employ engineers who have visited Europe and who also have written to personal friends for data affecting the problem of the construction of high masonry dams. The information secured would not have been given to this city or to the commissioners without compensation, yet it has been freely given in private correspondence to gentlemen who have been able to utilize it for the benefit of this city. It is now some six weeks since the Aqueduct Report was published, and the distribution of the volumes has been put in the hands of a sub-committee of

the Commission, consisting of William Dowd, Hamilton Fish, Jr., and E. L. Ridgway, yet at last accounts the engineers of the Commission had been unable to secure the volumes that should have been promptly given to them before a single copy was given or sold to any one else, so that they might have been enabled to send a copy to the engineers to whom they are personally indebted for courtesies received.

Besides, this committee have been unable to decide, until within a few days, what price they wanted American engineers to pay for them. After waiting some weeks, we secured several copies last week, to send to gentlemen in Europe, by paying five dollars apiece for them, yet we learn that several hundred of these volumes have been freely given to politicians and their friends. Since two engineers are members of the Commission, it is unfortunate that these two gentlemen were not on the committee, since they would have been able to appreciate the propriety of doing what the present committee are clearly incapable of recognizing. It is perfectly proper that the volumes should be sold to anybody who may want them, but before any volumes are sold, the engineers that have been employed by the city should be requested to furnish a list of the gentlemen to whom they are indebted for information, and to such they should be permitted to send, with their personal compliments, a copy of this report. After that obligation is met, a price can be designated at which volumes may be sold.

In this connection it is a pleasure to commend the action of the authorities of the city of Providence as a gratifying exception to the methods we have here criticised. When their engineer makes a report, which reports are always of value, they make a liberal appropriation for their publication, and they allow him to designate, to a large extent, where these reports shall be sent. On the other hand, our Aqueduct Commissioners seem to think that politicians and their friends are the only people to whom they are in any way indebted.

FIRE PROTECTION IN PARIS THEATRES.

FROM *Le Genie Civil* we learn that, after the burning of the Nice Theatre, the Prefect of Police put forth an ordinance to regulate the construction and management of theatres. The police have found it impossible to enforce these ordinances without closing the theatres owned by private proprietors, as these proprietors preferred to pay the fines imposed upon them for non-comformity with the regulations rather than expend the sums necessary to obey them.

The directors of the Government and municipal theatres have been, until the burning of the Opera Comique, unable to get appropriations to carry out fully the works required by the new law, although certain attempts were made in the municipal theatres and in the Grand Opera House to conform to the principal conditions of the ordinance.

M. Chenier, who has given much study to the subject, blames the public for the disregard which the managements have shown for these ordinances; for the theatre-goers do not demand the most thorough guarantees of safety and are content, not only with crowding and discomfort, but with exits most insufficient in case of fire.

Le Genie Civil suggests that the police should fix posters, warning the public, at the entrance of all places of amusement which do not conform in their construction and management to the city regulations, as a better means of enforcing those regulations, than by fining the proprietors or closing the theatres. The new regulations will be found elsewhere in this issue.

REAL RAPID TRANSIT.

THE Rapid Transit Commission of this city have, in a report to the Mayor, recommended as a solution of the rapid-transit problem what THE SANITARY ENGINEER AND CONSTRUCTION RECORD has for several years been advocating—namely, a solid viaduct line on property bought and paid for. They submit their conclusions as follows:

"We are led to the conclusion that there is but one way to obtain such rapid transit, and that is by the construc-

FROM WALL STREET	Distance. Miles.	Time. Minutes.
To City Hall.....	$\frac{1}{4}$	$1\frac{1}{4}$ to $1\frac{1}{2}$
To Union Square.....	$\frac{1}{2}$	5 to 6
To Madison Square.....	$\frac{3}{4}$	6 to 7
To Forty-second Street.....	$3\frac{1}{4}$	9 to 10

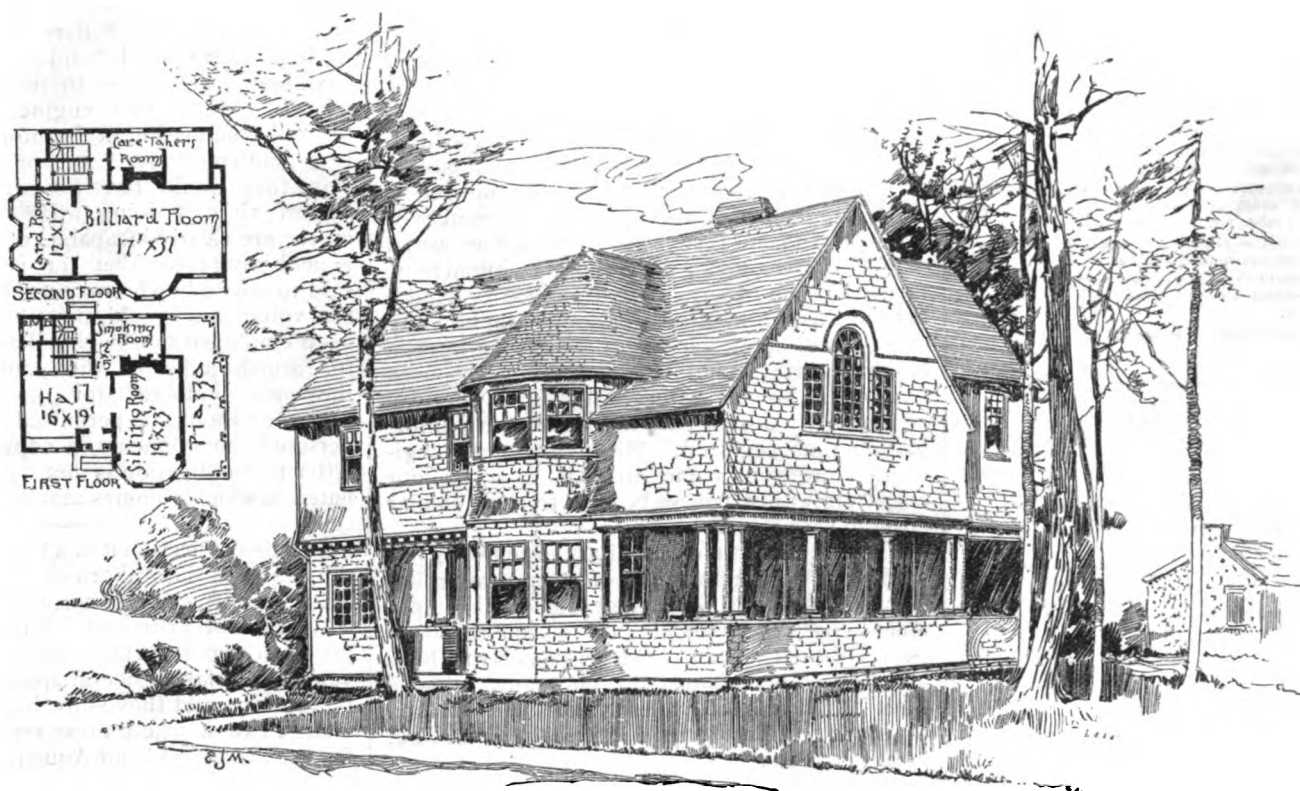
The longer the building of a road of this character is put off the more it will cost, since the property needed will materially increase in value.

PHILADELPHIA PUBLIC SPIRIT.

TWO GREAT national events have been celebrated in Philadelphia in the last eleven years, the second but a few days ago. That city deserves to be congratulated, because the success of her celebrations is due to her being a thoroughly American city, and possessed of a proper pride in her past and her historical monuments. A few New York citizens and newspapers now and then amuse themselves with projecting some national celebration—in 1889

TESTING ZALINSKI'S PNEUMATIC GUN.

A TEST was made on Tuesday of the effect on a vessel of the explosion of the dynamite shells thrown from the air-gun, or cannon, devised by Lieutenant E. L. Zalinski, U. S. A. The schooner "Silliman," an old wooden Government vessel, was anchored about a mile and a quarter from Fort Lafayette, New York Harbor, where the gun is being tested. After two shots had been fired to get the range, a shell containing fifty-five pounds of explosive gelatine and dynamite was fired, striking the water very near the vessel. The explosion took one of the schooner's masts short off, damaged her wood-work, and threw a large quantity of water on her decks and into the hold. A second fifty-five-pound shell exploding near the hull, shattered it badly, the vessel sinking immediately. The test was made in the presence of Secretary Whitney, U. S. N., and several officers of the army and navy, and other scientific gentlemen. The result was considered a success, and Lieutenant Zalinski was warmly congratulated.



CLUB HOUSE AT GLEN RIDGE, N. J.—WILLIAM CONVERS HAZLETT, ARCHITECT.

tion of a solid viaduct line through the blocks, as far as possible, and when compelled to cross or follow the lines of streets to be constructed with much greater strength and solidity than the present elevated railroads. Such a viaduct road should be built in accordance with the following conditions:

"First—The structure should be built through the blocks of brick and stone in the most solid manner. The streets should be crossed by massive steel girders with solid steel floors, having no openings. The track should consist of heavy steel rails on ties laid in an elastic material between floor and ties. There would be no jar or break of continuity of motion in such a structure, and trains could be run at high speed with little noise.

"Second—The stations should be not less than one-half mile apart and long enough for ten cars. The cars should be as wide as possible.

"Third—Trains should be run by independent motors, and as frequently as on the elevated roads, and at a speed of at least twenty-five miles per hour, including stops. This would enable the trip to be made—

for instance—and then nobody cares, the effort falls flat, and New Yorkers buy railroad tickets to another town. The difference seems to be that New York has gathered in the people of every land, until her American spirit, and the pride of a few in her unique history, cannot be asserted. It is left, therefore, to Philadelphia, and Boston in a lesser degree, to celebrate, from time to time, events in which every American feels a just pride. Besides, its "social leaders" do not feel it necessary to leave town whenever a historical celebration is to take place. Consequently it does these things well. For this reason, we say, Philadelphia deserves to be congratulated.

MAYOR HEWITT made a mistake in proposing that two regiments should use the same armory. Colonel George D. Scott, of the Eighth Regiment, very properly, in an interview with a New York *Herald* reporter, took the ground that armories should be located in different parts of the city, "both for purposes of safety and for convenience in recruiting."

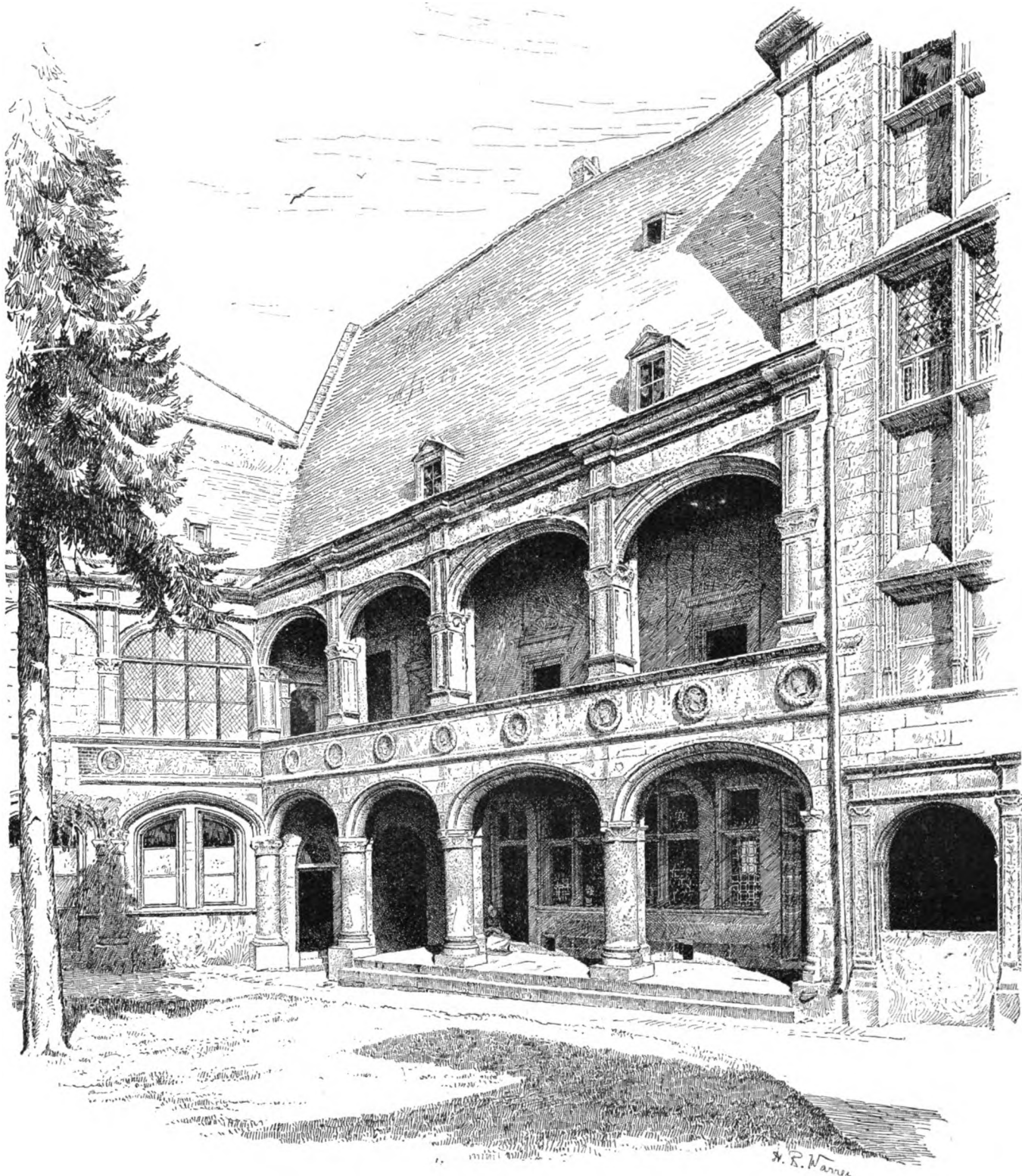
THE Trustees of the Brooklyn Bridge have received from Charles E. Emery, C. E., detailed plans for the alterations in the Bridge terminal. These are modified from original general plans presented by Mr. Emery some months ago, and the Trustees have appointed Mr. F. K. Hain, General Manager of the New York Elevated Railroads, Colonel Julius W. Adams, C. E., and an expert from the Pennsylvania Railroad to consider and report upon them.

OUR SPECIAL ILLUSTRATION.

HOTEL D'ALMY, BLOIS, FRANCE.

OUR VIGNETTE ILLUSTRATION.

OUR vignette illustration shows a club-house at Glen Ridge, N. J. It is built of wood, covered with shingles. All of the rooms, except those of the care-takers, are finished in hard wood. The billiard-room has paneled wainscot eight feet high and barrel-vaulted. Cost, \$8,000. The architect was William Convers Hazlett, of 151 Broadway, New York.



THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

HOTEL D'ALMY,

BLOIS. FRANCE.

VOLUME XVI.

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PARIS ORDINANCE CONCERNING THEATRES.

FROM the Police Ordinance concerning theatres, we quote the following :

ARTICLE 4. A theatre comprises :

First—The auditorium and its approaches.

Second—The stage, with its basement and its flies.

Third—The actors' rooms and the offices of the management.

ART. 5. The theatre must be isolated or back to back with another building. In case of isolation there must be left upon the sides which are not upon public streets a space or an alleyway of no more than three metres in width if the neighboring buildings have no windows opening on the said space. But if such is not the case the width will be required to be greater according to the importance and the character of the building. Where a theatre is back to back with another building a brick wall of at least 0m. 25 thickness must be built to protect the party wall.

ART. 6. No door of communication can exist between neighboring properties and the alleyway in the case of an isolated theatre, nor with the interior of any part of the theatre whatsoever where the buildings are back to back.

ART. 7. The three parts of the theatre must be separated by large masonry walls entirely constructed of and covered with incombustible materials. The auditorium and the offices of the management should have distinct exits.

ART. 8. The ceilings and the dome of the auditorium must be built of iron pugged with masonry. Nothing can be put upon the ceilings without the consent of the authorities.

ART. 9. The great wall of the stage front can only be pierced by :

First—The stage opening, which shall be closed by a rolling curtain of iron composed of meshes not more than 0m. 03 in size. The curtain shall be held up by combustible cords. Counter weights hung by metal cables should moderate the quickness of its descent.

Second—The passages required for the relief service, whose position shall be designated by the Commission of the Theatres and which shall be closed by iron doors, a key for which shall be given to the Commissary of Police and another to the members of the fire department. A third key shall be placed on the stage side, near the doors, in a box inclosed by a fixed pane of glass with an explanatory inscription.

ART. 10. The decorations set upon the higher parts of the opening of the stage front ought always to be incombustible, as well as the curtains inclosing the scene.

ART. 11. All cloth used in decoration should adhere closely to the surface which it covers, and particularly to that of the ceiling of the auditorium. The space along this ceiling ought to be entirely empty, nothing being placed there except the apparatus necessary for the management of the chandelier.

ART. 12. The chandelier shall be held up by an iron brace, and managed by a wheel worked by pedals. Its falling shall be moderated by counter-weights, and it shall be hung by two metal cables, each having the same strength to resist a fracture, calculated upon the whole weight of the apparatus.

A metallic netting, with meshes of sufficient strength, shall protect the audience from the possible fall of glass or crystals.

ART. 13. The great rear stage-wall and the side-walls shall show a uniform surface, with no part setting back from its face line or from the perpendicular. These walls shall be pierced only by the openings necessary for the passage of the actors. These openings shall be fitted with iron doors swinging in such a way as to be constantly shut.

In every case where these walls give upon the isolating courts, there shall be set up, at the height of each service-bridge, an exterior balcony, with hand-rail and a fixed iron ladder for the passage of firemen.

In the other case, the roofs of the adjoining structures belonging to the theatre shall be built in such wise that a balcony of safety can be placed under the same conditions.

The passages of access from balconies of safety shall be furnished with iron doors closed only by a latch and opening both ways.

ART. 14. The lobby for the prompter and that for the musicians, formed either by a brick wall or by incombustible partitions, shall be plastered, tiled, slated, or cemented.

ART. 15. No boxes can be placed on the stage without the consent of the Commission of Theatres.

ART. 16. All the scenery shall be made unflammable by means of some preparation for that purpose.

Before being put in use, they shall be tested for their unflammability before the Commission of Theatres, or before one of its members delegated for that purpose.

These tests shall be renewed at least every six months, and they shall be accepted each time by the fixing of a seal at different points.

ART. 17. The doors of the actors' dressing-rooms, of lobbies, as well as the offices of the management, shall be furnished with a grating set in such a way as to facilitate the inspection by the firemen during the rounds required by law.

If these places are lined with lockers the trims of lockers shall be set close upon the floors.

ART. 18. The walls can be decorated with paper glued on, or with tapestry stuffs closely holding to the surface. Cloak-pegs, curtains, and portieres shall be fixed 0m. 70 at least from the vertical plane in which are the gas-jets.

ART. 19. No workshop or storeroom whatever can be placed in the parts of the theatre constituting the auditorium, the stage, and their dependencies.

They cannot be placed in the other division of the theatre without special permission from the authorities.

ART. 20. The storage-room for scenery and properties should be established outside the precincts of the theatre. Only such scenery and properties as are necessary for the running of the plays can be kept within the theatre. The place of storage should be separated from the rest of the structure by a thick masonry wall with iron doors.

ART. 21. No laboratory or storage place for any explosives whatever can be in the theatre.

ART. 22. All the staircases, those that serve the actors' dressing-rooms and the offices of the management, as well as those intended for the public, shall be, besides being dressed with stone, made in such a manner that the steps may be pugged full of masonry held in place by iron braces; the treads only of the steps can be of wood. The staircases intended for the public should be always straight.

ART. 23. The width of staircases for the public and the landings of same shall not be less than 1m. 50 in width.

Starting from the highest story this width shall be increased at each run proportionately to the number of persons who would use it at the time of going out, if the builders do not choose the better plan of giving the staircase throughout its full height the width of the run from the first floor to the ground floor.

ART. 24. The landings of staircases intended for the public cannot be furnished with gates except by the special permission of the authorities.

ART. 25. There should be at least two staircases especially intended for the public and independent of each other. These staircases should serve each story and give exit at the front of the building.

ART. 26. The width of the corridors of exit, and that of the doors leading out, whether of the lobbies of the auditorium to the vestibule, or from the vestibule out, shall be proportional to the size of the theatre.

ART. 27. The total width of openings communicating with the lobby to the vestibule of exit shall never be less than 6 metres for theatres having 1,000 seats or under. The opening of the vestibule on the outside shall satisfy the same condition; if it is divided into several doors, separated by piers, the number cannot be less than 3, and each ought to be at least 2m. 50 in width.

The doors connecting from the vestibule to the cafés, lobbies or adjoining apartments having exit outside will not be counted in the reckoning of these openings.

ART. 28. When the auditorium has more than 1,000 seats, these openings should have the regulation width increased by 0m. 60 for each 100 seats.

ART. 29. The auditorium shall be circumscribed at each story by a lobby of a uniform width, the minimum of which shall be 2m. 50.

ART. 30. The doors opening from the auditorium into this lobby shall be so hinged that they swing fully back upon the exterior facing of the partition and in the direction of the places of exit. The less important doors of the ground floor should swing out from the auditorium to the vestibule.

ART. 31. All the doors opening on the outer walls ought to remain open during the whole of the performance. They can be furnished with vestibules of light construction.

ART. 32. These screens should have their openings at the side, always flap doors, and together represent the same width as the opening stopped by the vestibule. The front of these vestibules shall be pierced by a door in two flaps, each having the same total width and which shall never be closed by lock and key.

ART. 33. All the seats placed in the pit and those of the "amphitheatre" shall be served by two lateral passages, having a minimum width of one metre at least; they shall be divided in the middle by a passage of 1m. 30 leading out to the exit lobby. Together the doors of communication of the seats of the ground floor to the lobby which surrounds the auditorium should have, at least, a total width of six metres. These doors should be placed as near as possible to the outer vestibule.

ART. 34. The rows of chairs, stalls, or benches shall be spaced 0m. 50 from the seat to the back in front. The same distance shall be kept between the benches. The seats of chairs and stalls ought to fold back against back.

ART. 35. No part of the theatre can be heated by any means but registers, the furnace for which shall be in the basement.

The hot-air pipes shall be made of earthenware, with shells 0m. 0.6 thick.

ART. 36. The registers placed on the stage shall be put up 0m. 30 above the floor, and shall be surrounded by metal grilles set 0m. 30 from their outside surface. The register openings placed in the other parts of the theatre shall be set 0m. 16 from all wood-work, such as floors, plinths, wainscots, etc.

ART. 37. The auditorium should be comfortably ventilated by means of appliances which shall be submitted to the approval of the Commission of Theatres.

ART. 38. If gas is used for lighting, there shall be a tell-tale for each part of the theatre.

Pipes more than 0m. 10 in diameter shall be of iron.

ART. 39. If the theatre is lighted by electricity and steam-engines used for this purpose, the engines should be placed outside of the building, or at least be set after a manner especially permitted after consultation with the Commission of Theatres.

The wires should be isolated by a gutta-percha covering and set, throughout their whole run, in an incombustible conduit.

The lighting apparatus should be so arranged as to prevent the dropping of burning carbon.

ART. 40. The use of gasoline, of mineral oils, of hydrocarbons, etc., is absolutely forbidden.

ART. 41. Oil-lamps, furnished with glass shades, and kept lighted from the beginning to the end of the performance, shall be placed in sufficient number in all places where there are openings to prevent total darkness in case of the total extinction of gas or electric light.

The tools, wicks and rags for these lamps shall be enclosed in a metal box.

ART. 42. The stage-lights shall be surrounded by a netting sufficiently away from the fire to prevent the contact of any flying object.

ART. 43. The brackets for gas and stage lights shall be placed in the same vertical plane to prevent any contact with the feeding pipe.

ART. 44. The stage-lights must be hung by three wires at least.

The feeding-pipe for the stage-lights shall be always held up to a height above the highest frame by a proper appliance.

ART. 45. The stage-lights shall always be worked vertically; they can be only lighted in the presence of firemen who are to fix the height at which the lights can be withdrawn.

The calcium-light shall be protected by a wire netting and mounted upon a secure standard.

ART. 46. The lights at the stage front shall be fitted with reserved flames. The footlights shall be furnished with wire nettings of tight mesh forming brackets above the jets.

ART. 47. The movable lights shall be protected as high as a man by netting of tight mesh, and the upper part of said lights shall be crowned by a hood of proper size.

ART. 48. The dressing-rooms and the lobbies for the actors, lighted by gas, shall have jets without elbows; the jets shall be covered by glass globes or with wire netting. The apparatus for movable lighting is forbidden in this part of the theatre.

ART. 49. The passages and the staircases shall be lighted by fixed glazed lights and furnished with wire shades.

For direct means of protection against fires, the authorities demand that there shall be in each theatre a hydrant with sufficient pressure to throw to the highest parts; that there shall be ample reservoirs of water in connection with these hydrants; that there shall be fire-pumps set on the ground-floor and in the basements; that fire-escapes shall be set upon all court and exterior walls; that there shall be telegraphic communication with the nearest fire-engine house.

In regard to offices in connection with the theatres, the regulations require that there should be an office for the police, for the physician, a guard-room for the service-guard, a station for firemen near the wings. No smoking-room shall be provided in and no shops placed under the theatres without the approval of the authorities.

Sufficient sanitary accommodations to be approved by the authorities must be provided.

No booths can be set up in the theatres except for the doorkeeper and the ticket-officer.

The Commission of Theatres is composed as follows : The Secretary of the Prefecture of Police, who is President of the Commission, the Chief of the Cabinet, the Chief of Municipal Police, the Chief of the Theatre Department of the Police Service, the Chief Chemist of the Prefecture of Police, the Colonel of the Fire Department, the Chief Engineer of the Fire Department, the Chief Architect of the Prefecture of Police, the official architect of the district, the Commissary of Police of that division of the city, and the Peace-Officer of the district.

A sub-commission composed of certain members of the above commission shall visit each theatre at certain times, and the members of the commission and other authorities are sent at any time to give such supervision as may be thought necessary.

A Commissary of Police is stationed at all theatres during the performance with a squad of police proportioned to the size of the theatre.

The firemen are to be constantly in attendance.

There must be watchmen-indicators and electric-bells indicating the different stations.

Each theatre must have a corps of physicians, proportionate to the size of the theatre, one of whom must be

constantly in attendance during the performances. In the physician's office must be placed an ambulance call.

Other regulations are made which we think unnecessary to quote.

In 1882 the Theatre de l'Opéra Comique was reported by the Chief of the Fire Department as having the stage in a very dangerous condition on account of the large amount of scenery stored therein, and the close proximity of the storage-house for scenery in the Place Lourvis. He recommended that a special fire-proof building be built to receive scenery, etc., not in use. Other complaints were made in 1886 to the Government of the inadequate means of exit for actors and others employed in the theatre, of the storage of scenery in the basement.

On May 12, 1887, an attempt was made to get an appropriation to make the needed improvements, which was not adopted by the Government. Thirteen days after came the catastrophe.

The fire caught high up upon the scenery; the doors about the stage, which should have been kept closed in accordance with the regulations, were open, increasing the draught; the fire spread rapidly, and although the firemen were promptly at work they could not get it under control.

The man who was in charge of the iron curtain was not at his post, and the point where it was worked was high up in the flies.

Contrary to the regulations, the curtain was hung with wire ropes and it remained in place, and the smoke filled the auditorium; the gases of combustion put out the oil-lamps as well as the gas. The gas went out. The outside doors on the Rue Fasert were locked contrary to the regulations, and in the darkness the keys in the glass cases were not seen; certain staircases were not indicated so as to be known to the public.

Only two narrow staircases served the actors' dressing-rooms; luckily the fire did not occur during an intermission, when these rooms would have been occupied, or but few would have been saved.

The story of this fire is almost precisely the same as that of the Ring Theatre at Vienna.

DOWNFALL OF THE SUSPENSION BRIDGE OVER THE OSTRAWITZA.

FROM *Le Genie Civil* we get the following data regarding the destruction of the suspension bridge over the Ostrawitza, which united the part of the city of Ostraw in Moravia to that portion situated in Silesia, and gave way recently under the weight of half a score of persons, a detachment of cavalry of sixteen men, and two carriages which were crossing it. Men, horses, and carriages were thrown into the river. Many were killed by drowning or crushing under the ruins, and others were badly injured. The construction of this bridge was begun in 1846, under Engineer Tannebauer, but was interrupted during five years on account of violent floods in the Ostrawitza, which caused terrible inundations, so that the work could not be resumed

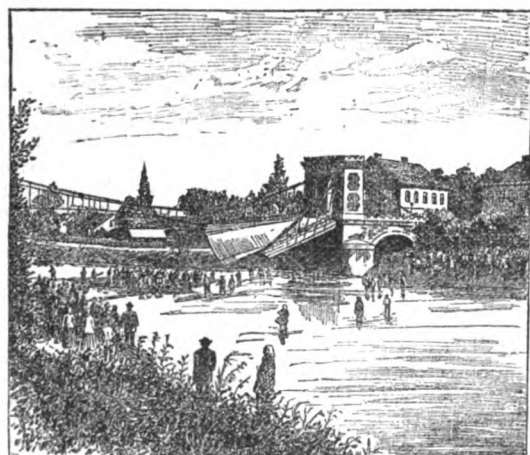


FIG. 1—GENERAL VIEW OF THE BRIDGE AFTER IT FELL.

until 1851. The bridge measured 92 metres long, 7.09 metres wide, and had a clear span of 66 metres. The floor was supported on each side by means of two chains placed side by side, each chain composed of 6 bars of iron 13 millimetres thick and 101 millimetres broad. The break occurred at one of the ends in the chamber in the anchorage masonry through which the chains passed, as shown in Fig. 2. The free end of the broken chains remained suspended from the tower, while the central span, or that portion which supported the floor, fell into the river as shown in Fig. 3.

At the point of rupture of the chain there remained eleven bars of iron; the twelfth, which was missing, was found in the chamber completely rusted, broken, and covered with dust, which showed plainly that for a long time before this, that bar, by reason of its bad condition, had become loosened from the chain. None of the broken bars showed a sound section of more than about 3 millimetres thick and 75 millimetres in breadth. This thin section was all that remained of the bars of the chain; the remaining portion of the section was completely rusted and torn or wrenched.

At the time of the bridge falling the load exceeded but little 13,000 kilogrammes, which represents about 200 kilogrammes per metre of length. No reason can be given why such a comparatively small load could cause this downfall, when but a short time before more than 300 persons were known to be on the bridge at one time. It is probable, then, that this was caused, as has been the case before (notably at the time of the legendary catastrophe of the bridge of Angero), by the regular marching, in time, of the cavalry crossing the bridge. It seems strange that this bridge had stood so long and had not failed even by its own weight. An approximate estimate of the tension of the chains gives substantially the following results: The weight of the chains, of which the sections combined measure $24 \times 13 \times 101 = 31,512$ square millimetres, becomes, by taking count of pins and eye-bar heads, about 270 kilogrammes per lineal metre. The weight of the floor-planks and joists, suspension rods, etc., may be taken at 1,500 kilogrammes per metre, making together 1,770 kilogrammes. If to this be added the 200 kilogrammes calculated as the moving load causing the downfall, we get 1,970 kilogrammes per metre as the total load.

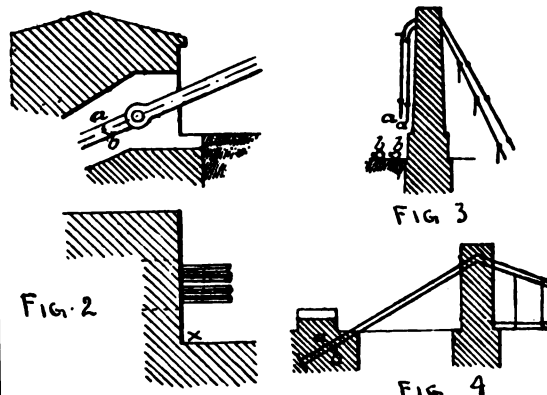


FIG. 2.—Showing the point of rupture of the chains at the anchorage.
FIG. 3.—Showing the position of the chains at the tower after the rupture.
FIG. 4.—Showing mode of attaching chains at the anchorage.

As the deflection of the chains in the centre span was 4.90 m. in round numbers, the horizontal tension due to the weight of the structure becomes

$$H = \frac{1}{8} \frac{1,770 \times 66^2}{4.90} = 197 \text{ tonnes,}$$

which became at the moment of the accident 219 tonnes. The vertical reaction at the tower due to the load on centre span was $V = \frac{1}{2} \times 1,770 \times 66 = 58,400$ kilogrammes for the permanent load and 65,000 kilogrammes for the total dead and live load. The tension of the chain was $\sqrt{H^2 + V^2} = 205,000$ kilogrammes for the permanent load and 228,000 kilogrammes for the total load. If we suppose that the load was distributed equally upon each one of the chains, and that, as mentioned above, the total sound section of the broken chain $11 \times 3 \text{ m.} \times 75 \text{ m.} = 2,475$ square millimetres, it follows that under the action of the dead weight alone, the tension was

$$\frac{102,500}{2,475} = 41 \text{ kilogrammes per square millimetre,}$$

which at the instant of rupture became

$$\frac{11,400}{2,475} = 46 \text{ kilogrammes per square millimetre.}$$

From this calculation the catastrophe seems perfectly comprehensible. Iron when employed to support an equal tension for a long time ought always to be of the best quality. The rapid deterioration of the iron (which is without precedent, and which during the thirty-five years of the existence of the bridge reduced the section to about one-fourth of what it was originally) proves that the anchorage chambers were badly constructed. All the foul waters of the streets could empty themselves into their interior. Besides which the angle of the parapet wall, which was just at the shore line, was constantly defiled by liquid ammonia, which ran down from the roadway and contributed in a great degree to the injury of the iron. After all this it may seem incredible that at the date of June 25, 1885, the municipality having some doubt of the strength of the bridge asked to have it examined by experts. At the date of July 18, 1885, they received notice that the bridge had been examined in all parts, it had been found in good condition, and was perfectly safe. Now it seems unquestionable that it is this bad condition which caused the accident, and that this condition existed evidently at the time of the inspection.

PAVEMENTS AND STREET RAILROADS.

No. XV.

(Continued from page 434.)

WOOD PAVEMENT IN THE METROPOLIS.*

OBVIOUSLY there are local matters to be considered in connection with wood pavement, for instance, the effect of traffic in a wood-paved street having a sharp gradient. This has not specially come under the author's notice, except at Ludgate Hill, where the blocks laid in 1877 were removed in February, 1884, having been, it is alleged "kicked out" by horses' shoes, and not fairly worn out by vehicles. The inclination of the carriageway of Ludgate Hill is 1 in 25. Similar results are noticeable at the Western approach to Hyde Park Corner, at which place the inclination is 1 in 37. The question of gradient in wood-paved streets is also an important factor in regard to the tractive action of horses and the limit of safety for foothold, and it is regrettable that so little experience thereon is extant. In the city the steepest gradient paved with wood is in Ludgate Hill; in some parts of Piccadilly the inclination is 1 in 25. It might therefore be assumed that, so far as actual safety is concerned, a gradient of 1 in 20 would not be too steep. In Chelsea the main roads are tolerably level, but there is little doubt that the annual wear of the blocks in King's Road (0.144 inch) is greater in consequence of the increased amount of omnibus traffic which has recently taken place, as, owing to a keen competition, omnibuses have been very rapidly driven along the street at times. A considerable amount of light traffic has also seriously tried the wood. In Sloane Street the nature of the traffic calls for no particular observation, and the annual wear of the wood (0.065 inch), together with the traffic-standard wear, gives a result which compares favorably and satisfactorily with any other street in London.

To insure durability, it may briefly be asserted that next to sound construction it is highly important that the number of openings for gas and water services should be limited, and that undue wear and tear can be mitigated by efficient cleansing and sanding. Neglect of the latter not only creates slipperiness, but is followed by permanent injury to the pavement itself.

In support of the author's views, he submits a number of blocks as taken up from various streets in the metropolis. Some are remarkable as specimens of excellent durability, while others exhibit considerable wear, and the very thin ones have created great surprise that a pavement could be held together with blocks so much worn.

Cost of Maintenance.—The author has frequently been asked whether the wood pavement laid in Chelsea has proved economical as compared with macadam, the answer to which may be found in the following statement, which is based upon the assumption that the average life of the wood blocks will be seven years, and which shows that the first cost, repairs, renewals, and cleansing, if spread over a period of twenty years, amounts to 1s. 9d. per square yard, whereas the previous cost of repairing, renewing, and cleansing macadam, but exclusive of first cost, amounted to 2s. 10d. per yard.

Estimated cost of wood pavement per square yard in Chelsea, for a period of twenty years.

	£.	s.	d.
First cost	0	10	6
Repairs	0	0	6
Renewal of blocks every seven years	0	12	8
Interest on loans (at 4 per cent)	0	2	9
	20	1	6
Per annum	0	1	4
Add cleansing and sanding	0	0	5
Total	0	1	9

If the cost be spread over a period of fifteen years only, the figures will be increased to 1s. 8½d. per yard per annum for the wood + 5d. for cleansing, or a total of 2s. 1¾d.

Under the above circumstances it may be fairly assumed that the annual cost of properly constructing, repairing, and renewing wood pavement, exclusive of cleansing, which is subjected to a traffic of 500 to 750 tons per yard width per day of sixteen hours, and leaving it in a thoroughly good condition at the expiration of fifteen years, does not exceed 1s. 9d. per square yard; whereas the average annual cost of repairing and renewing the macadamized carriageways in Sloane Street and King's Road, formerly amounted to 1s. 11d. per square yard, and in Westminster similar repairs cost:

	£.	s.	d.
In Parliament Street	2	10	
" Whitehall	2	10	½
" Victoria Street	2	0	
" Great George Street	1	8	

No doubt many similar instances might be adduced, in support of the assertion that, as a paving material, wood possesses the advantages of economy, independently of the saving in cleansing.

The annual cost per square yard for laying and maintaining wood pavements in various localities, including interest on loans, is given in Table VI. In most instances the actual cost has been supplied, and in the remainder it has been carefully estimated, after making due allowance for efficient and creditable maintenance.

* A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

VI.—Annual cost of various wood pavements.

System.	Situation.	Traffic weight per yard width per diem in tons.	Annual cost per square yard for first cost, renewals, repairs, and interest on loans (exclusive of cleansing) if spread over a period of 15 years.
Plain.	Sloane Street	279	1 3 1/4
Henson's.	Fuston Road	700	1 5 1/4
Plain (pitch pine).	King's Road	468	1 5 1/4
Crossed blocks (lime joint).	"	407	1 6 1/4
Henson's.	Oxford Street (C.)	948	1 8 1/4
Plain.	King's Road	551	1 8 1/4
Improved.	Leadenhall Street	808	1 9 1/4
Asphaltic.	Strand	1,100	1 10
Plain.	Edgware Road	584	1 10 1/4
" (asphaltic bed).	Oxford Street	1,164	1 10 1/4
Henson's.	King's Road	498	1 10 1/4
"	Oxford Street (F.)	1,101	1 10 1/4
"	Oxford Street (W.)	985	1 10 1/4
Crossed blocks (mastic joint).	King's Road	434	1 10 1/4
Asphaltic.	Regent Street	558	2 0
Improved.	Aldersgate Street	...	2 0
"	Northumberland Avenue	...	2 0
Asphaltic.	Fleet Street	1,359	3 0 1/4
Henson's.	"	1,165	2 1
Improved.	Oxford Street	985	2 1
Asphaltic.	Brompton Road	648	2 1 1/2
Henson's.	"	584	2 1 1/2
Improved.	Parliament Street	1,106	2 1 1/2
Lloyd's.	Regent Street	558	2 2 1/4
Asphaltic.	Oxford Street	1,137	2 2 1/4
Carey's.	Cannon Street	...	2 4
Henson's.	Leadenhall Street	1,000	2 8 1/2
Improved.	Ludgate Hill	1,236	2 9 1/2
"	Piccadilly	800	3 0
"	Knightsbridge	780	3 0
" (pitch pine).	King's Road	558	3 2
"	"	603	3 2

The author regrets that he has been unsuccessful in obtaining fuller information as to the cost per square yard relatively to the traffic weight per yard width, but such information as he has obtained he has classified in the following table, and from which certain deductions are drawn. Until local authorities, or those persons directly interested in the question, adopt measures for ascertaining the latter, a considerable amount of theory must necessarily be exercised in deciding the question of cost according to the weight of traffic.

SYSTEM.	DAILY TRAFFIC WEIGHT PER YARD WIDTH OF PAVEMENT.				
	400 tons.	500 tons.	750 tons.	1,000 tons.	1,250 tons.
Plain yellow deal.	s. d. 1 4	s. d. 1 6	s. d. 1 9	s. d. 1 10 1/2	s. d. 1 10 1/2
Plain pitch pine.	1 4	1 6	1 9	1 10 1/2	1 10 1/2
Crossed yellow deal.	1 6 1/2	1 10 1/4	1 9 1/2	1 11 1/2	2 0
Henson's.	...	...	...	...	...
Improved.	...	...	...	...	...
Asphaltic.	...	...	...	...	...
Lloyd's.	...	...	...	...	...

The figures undoubtedly give the plain system of pavement the highest position in an economical point of view, and show the comparative cost of other systems in a manner not hitherto attainable.

It is apparent that as the minimum net cost of a soundly constructed and properly maintained wood pavement amounts to 1s. 9d. per square yard for a traffic of 500, and not exceeding 750, tons per yard width, the absurdity of some of the maintenance contracts which have been entered into is remarkable. On the other hand, a good bargain was made by the Improved Wood Pavement Co. in 1876, when they undertook to lay and maintain a large area in Piccadilly, also upward of 2,000 square yards in King's Road, upon the "deferred payment" system, the rate for Piccadilly being 3s. per square yard per annum for a period of fifteen years. The result will consequently be that no less than 45s. per square yard will eventually be paid for an expenditure which in all probability will not greatly exceed 30s. In justice to the authorities, who entered into so costly a contract, it should be stated that in the year 1876 the modern system of wood pavement was in its infancy, and that public bodies were somewhat timid in incurring large outlays thereon; and as the contract stipulated that payment would cease immediately the contractors failed to efficiently maintain the pavement, it was considered that the risk would be small, as a proportionate amount only would have been paid.

Much trouble has been caused by public boards accepting low tenders for first cost, and ridiculously low terms for continuous maintenance, and it has been truly stated on a former occasion by Mr. Burt, that some persons "were running a race to see which could get ruined the fastest." This prophecy has been literally fulfilled, but, unfortunately, as in the case of asphalt and other systems of pavement when improperly undertaken, the consequences had seriously damaged the reputation of wood pavement. Considering that persons enter into contracts to efficiently maintain large areas of pavements with a daily traffic of 600 or 700 tons per yard width, for a period

of fifteen years, for the sum of 9s. per yard, whereas the net cost in all probability will amount to 13s., it is obvious that either the pavements will be insufficiently repaired or renewed, and the reputation of wood injured, or that "a day of reckoning" must come. With the experience already gained, it cannot be too strongly urged that public authorities should look ahead, and not accept a tender merely because it happens to be the lowest. Another matter ought perhaps to be mentioned, although, perhaps, a somewhat invidious one—namely, that ample and competent supervision should be provided, so that every detail in the execution of the works, especially the rejection of unsound blocks, may receive attention. The operation of inspecting every block is undoubtedly tedious; for example, in the Chelsea works, where the timber supplied was of fair quality, it was found necessary to separately sort out, reject, and mark about one block in twenty, the rejections being 96,000 out of a total delivery of nearly 2,000,000; and there is little doubt that, owing to the hurry of the work, many blocks were laid which escaped rejection, but assuredly these will be the first to fail. In works of considerable extent it would undoubtedly be a prudent expenditure to employ a competent inspector to look after the blocks alone.

To sum up, the author ventures to assert that a properly constructed and kept wood pavement meets with favor. He has personally ascertained that shopkeepers and residents like it, in consequence of the absence of noise, and the absence of the inconvenience usually experienced by the frequent closing of the carriageway for repairs, as in the case of macadam; that cabmen give it their unqualified approval; and that the Managing Director of the London General Omnibus Company prefers it, if properly kept, to either granite, asphalt, or macadam. Of course, exceptions have to be made in this as in all other cases, but the public generally appear to be satisfied with it. There are sections of the community, however who do not view it with favor, especially carriage-builders, wheelwrights, saddlers, and granite merchants; but their disapproval will be readily understood. The improved condition of the carriageways of some of the best thoroughfares has also created a favorable impression upon strangers which has not been lost, inasmuch as deputations have inspected the various systems and made numerous inquiries into their respective merits, not only on the part of the municipalities of the principal towns in Great Britain, but from France, Germany, and other countries. At the present time a large amount of wood pavement is being laid in Paris and Berlin by the Improved Wood Pavement Company.

The author has described somewhat fully the details of what may be considered to be mere ordinary matters, but as the success or failure of wood pavement mainly depends upon a careful consideration of apparent trifles, he trusts that he may be pardoned for having taken this course. He is of opinion that local authorities should invariably adopt measures for ascertaining the traffic-weight per yard width in a street before deciding to lay down wood pavement, as such information might prevent contractors from submitting a maintenance-tender regardless of the duty the pavement has to perform, and that complete records of annual cost and wear should be kept. He again ventures to remark that it cannot be too strongly urged that the greatest discretion should be exercised in the acceptance of tenders for construction and maintenance, and that no reasonable expense should be spared in providing ample and competent supervision. Under these circumstances he is of opinion that a close-jointed plain system of pavement, judiciously and faithfully carried out, and improved upon from time to time, will give good economic results, as well as insure a sound and suitable carriageway pavement.

Lastly, the author submits:

- (1.) That where the ascertained annual cost of maintaining and cleansing a macadamized carriageway exceeds 2s. 2d. per square yard, or where the traffic is so considerable that a quieter and cleaner pavement is deemed essential, the substitution of wood is desirable.
- (2.) That experience has proved wood pavement to be an economical and a convenient carriageway pavement for the streets of the metropolis.
- (3.) That, notwithstanding many former instances of failure, the modern system has achieved a fair amount of success, and there is no apparent reason why its use should not be extended.

(TO BE CONTINUED.)

WORK OF MISSISSIPPI RIVER COMMISSION.

FROM recent reports of the Mississippi River Commission the evil effects of the attempt by Congress to legislate on purely technical matters becomes apparent. The act of August 5, 1886, provides "That no works of bank protection or revetment shall be executed in said reaches or elsewhere until after it shall be found that the completion of the permeable contracting works and uniform width of the high-water channel will not secure the desired stability of the river banks."

Quoting this, the Commission proceed to remark that the "limitation is based, it is believed, on the theory that a river, if once regulated, will not scour its natural banks. The Commission is somewhat familiar with the opinions and writings of hydraulic engineers, and, so far as it is advised, this theory is totally unrecognized by any authoritative writer on hydraulics. It is universally recognized

by such writers that in general when a large obstruction is placed on one bank of a river a corresponding wearing away of the opposite bank occurs in consequence.

"There is no evidence that a regulated river will not cave its banks, and in most cases it is impossible to build permeable contracting works or secure any narrowing of the channel by them without holding the banks in their immediate neighborhood while the work is going on; the unprotected banks would recede while the contracting works were being built.

"These general views are fully confirmed by the experience of the Commission on the Mississippi river.

"The contraction works at Gold Dust, Plum Point, Duncansby, and Baleshed have been followed by caving on the opposite bank, whose immediate result is, by again enlarging the cross-section of the river, to destroy any beneficial results the contraction works might otherwise produce.

"That such works may secure any valuable permanent contraction, the opposite bank must in general be held by protection works.

"In the opinion of the Commission the idea that the Mississippi River can be permanently improved by contraction works alone is purely visionary and theoretical, contradicted by experience and not supported by any good authority. To adopt such a system is, in the opinion of the Commission, to waste public money. Holding these views, the Commission, as engineers, cannot recommend to Congress so futile an undertaking.

"In the work which has been done in the Plum Point and Lake Providence reaches, the plan which has been so frequently and explicitly recommended by the Commission in previous reports, and which embraces the combination of permeable contracting works and bank protection as means of narrowing and deepening the channel, has been applied."

Notwithstanding the difficulties of great floods, and a failure of appropriations at critical periods, a navigable channel has been maintained in the lowest water, and the Commission say:

"Before these works were begun these reaches were the worst places on the river. It was for that reason that their improvement was undertaken first in order. They are now good.

"These successful and gratifying results have been obtained by the combination of permeable contracting works and bank protection, each supplementing and aiding the other, and, in the opinion of the Commission, could not have been obtained by permeable contracting works alone."

The Commission also call attention to the serious deterioration going on at the works for lack of needed appropriations.

The report is signed by all, but General Gillmore makes the following reservation:

"I concur very generally with the views expressed in the foregoing letter, and have accordingly signed it as president of the Commission, with the following reservation on the subject of bank protection: The revetment of a caving bank with mattresses or other similar device is perhaps the quickest way to afford protection, for the reason that it interposes a covering capable of resisting the wearing and undermining action of impinging water. But the most complete and efficacious method requires that the current be turned away from the threatened bank. This can best be done usually by permeable dikes placed above the point in danger and requiring protection, having their lengths severally adjusted to the object in view."

Captain Thomas Turtle, of U. S. Engineers, in transmitting maps of changes which have occurred in connection with the work accomplished, makes the general remark:

"So far as the construction of dikes relates to the caving of banks, those so far built have only initiated such caving or accelerated it." (Italics ours.)

Assistant Engineer J. S. Ockerson, in transmitting the maps, says of one section (in proof of the Commission's position): "Fletcher's has been partially revetted, and the greater portion of the bank thus protected has resisted the encroachment of the waters which have cut into the unprotected portions some 400 feet during the past two years."

The caving caused by the Gold Dust dikes he places at 600 feet per annum, as against 100 feet before they were built.

At one bend in the Lake Providence reach, the caving in six years has been 3,000 feet, and at another bend 2,000 feet in two years.

The citizens of the United States as a whole are willing that those who have been educated for it shall carry through the great work of regulating and controlling this mighty river. Having chosen a Commission, fair play demands that they be unhampered by the petty restrictions as to methods which a few cranks have succeeded in attaching to the appropriations. It is but human that some mistakes will be made, but the Commission are not men to persist in a mistake when it is once clearly shown by experience to be such; and the mistakes made will but prove to show them the way to right relations of the many problems presented. It seems hopeless to expect that Congress will ever learn this very plain lesson.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

By WILLIAM R. BILLINGS, C. E.,
Superintendent of Water-Works, Taunton, Mass.

[SOME questions addressed by persons in the employ of new water-works indicated that a short series of practical articles on the details of constructing a water-works plant, included in which would be the laying of pipes, setting hydrants, laying services, etc., would be of value if prepared by a gentleman of experience. We therefore induced Mr. W. R. Billings, the Superintendent of the Water-Works at Taunton, Mass., to prepare them. The illustrations we shall give are from sketches made by Mr. Billings.—Ed.]

The Introductory Chapter will deal with—
THE DISTRIBUTING SYSTEM.

(a) Main pipes.

Materials.—Cast Iron, Wrought Iron and Cement, Wood, Clay.

List of Tools.—Illustrated. (7 sketches.)

Transportation.—Unloading, carting.

Trenching.—Engineering or none; Length and depth of sections; Foreman; Bracing; Bell holes; Tunneling.

Pipe-Laying.—Derrick gang; Quicksand; 3 pieces at once.

Joint Making.—Yarn; Lead; Fuel; Roll or Joiner; How many joints in ten hours; Depth of lead; Shape of bell; Placing hydrants and gates; Back-filling; Filling new pipes; Air cocks; Cleaning up.

(b) Service pipe.

Materials.—Tapping; Cup joints; Tools; Cocks; Boxes; Setting meters; Support for meters.

No. 1.

In the series of papers upon Some Details of Water-Works Construction, of which this is the first, it will be the writer's endeavor to be brief and practical.

He assumes that those for whom these papers will have the most interest have had little or no experience in actual construction, and desire information and suggestion upon the simplest details.

MAIN PIPES.

Materials.—Cast iron, wrought iron with cement or with a protecting coating by some special process, wood, and steel are the materials used in making pipes for the distributing systems of town and city water-supplies.

Salt-glazed vitrified clay pipes have been used by Mr. Stephen E. Babcock, C. E., of Little Falls, N. Y., in that village, and also at Amsterdam and Johnstown in the same State, for conduits in gravity systems. At Little Falls the conduit is over 30,000 feet in length and is mainly of 18 and 20 inch pipe. The low first cost of clay pipe would certainly entitle its claims to careful investigation in planning a low-pressure gravity system of supply. Mr. Babcock has prepared a very elaborate set of specifications for furnishing and laying this pipe, which would be of value to any one who wished to use it.

The writer frankly acknowledges a preference for cast-iron pipe for all but special cases. He is not unmindful of the fact that the town of Plymouth, Mass., after an experience of thirty years is this summer (1887), extending its distributing system by adding 20,000 feet of 4 to 16 inch cement-lined wrought-iron pipe; nor that the town of Dedham, Mass., has had no reason thus far to regret that its water-mains are of this material. Without going further, the cities of Fitchburg and Worcester, Mass., seem to offer experience with this sort of pipe to justify the opinion that the chances for poor work and poor material are greater with it than with cast iron, and the advocates of cement-lined pipe admit, I think, that honest and skillful work is indispensable to the success of this method. We must admit that when made and laid upon honor, cement-lined pipe has an advantage over cast iron in not reducing its original diameter by incrustations, nor is the "advantage out" when we reply that the cleaning machine of Mr. Keating or of Mr. Sweeney may be used to restore tuberculated iron pipe to its original diameter, for the application of these machines cannot be effected without expense.

With its acknowledged advantages of strength and ease in laying, cast-iron pipe is heavy and in its larger sizes expensive to handle. This limits the length in which sections of it can be used, and so does not permit of any reduction in the number of joints to the mile.

In the effort to produce something which should be free from these disadvantages of cast-iron pipe, wrought-iron

pipe treated by a protective process is now upon the market, and has been introduced to a limited extent. Of this it is fair to say that it is still on trial, and some time must yet elapse before its durability can be said to be proven.

Of wood, the writer has no knowledge by actual experience, but its use seems to be limited to a small territory in the West.

Unlike cast-iron pipe, which is bought ready for use, cement-lined pipe is put together in part at some convenient yard or shop in the town which is to use it, and its final construction is carried on in the trench where it is to lie.

The foundation of this sort of pipe is a sheet-iron drum nine feet in length, made in three sections in the 16-inch and larger sizes, and in single sheets in the 4 to 14-inch diameters.

The thickness of metal varies with the sizes; for example we may use

For 4-inch pipe, metal of at Birmingham Gauge,			
" 6 "	" 19 "	" "	" "
" 10 "	" 17 "	" "	" "
" 12 "	" 15 "	" "	" "
" 14 "	" 14 "	" "	" "
" 16 "	" 14 "	" "	" "

with double-riveted seams, using 12-pound rivets for 16, 14 and 12 inch pipe, 10-pound for 10-inch, 6-pound for 6-inch, and 5-pound for 4-inch pipes.

The first step in the making of this sort of pipe is the putting into these drums a lining $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in thickness of cement mortar mixed sand and cement half and half.

The pipe is placed on end over a hole in a low platform, and a lining cone is let down into it from a crane, a derrick, or a simple windlass, and drops through the hole in the platform just far enough to allow the pipe to be entirely filled at its lower end with the mortar. Enough mortar is then shoveled into the top of the pipe from a high platform to make the lining, and the cone is drawn slowly through. The surplus cement as it falls over the top during the upward movement of the cone is shoveled back into the mixing-box, or into another pipe if there be one at hand ready for lining, but no cement that has once set is fit to be used again. After the cone is drawn the pipe should stand 20 minutes or more before it is moved;

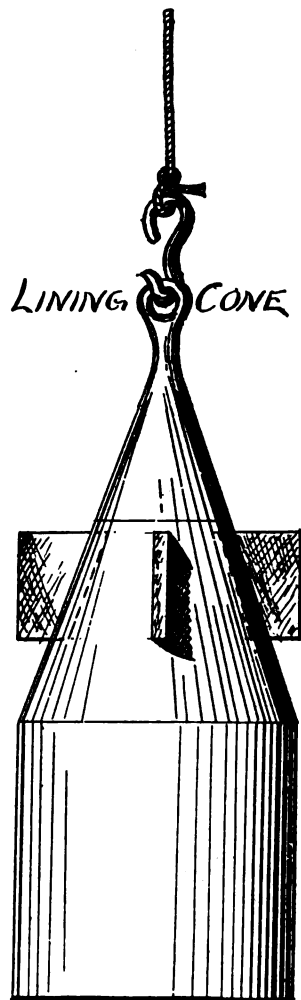


FIG. 1.

it is then taken to the grouting table, the ends scraped, and the whole surface examined for defects. If at any points the cement has settled into wrinkles these should be scraped down, and any holes filled with pure cement.

With platforms and swinging crane arranged to place ten pipes on end at once for lining, eight men can fill 100 14-inch pipes in a day, and three men more can grout and patch them.

The grout can be poured in with a dipper, and then spread by rolling the pipe and applying from each end common dust-brushes fastened to long handles.

Before applying the grout the lining is brushed with water, using the long-handled brushes.

The lining cones are made either of cast-iron or of sheet-metal, but if the latter is used they must be filled with cement to give them weight.

LIST OF TOOLS.

Whatever be the material chosen for main pipe, the trenching tools will be the same. In the matter of pipe cutting and jointing, cast iron and wrought iron call for very different treatment and appliances. During days which are too stormy for work and over night, all tools should be securely packed in tool-boxes which may be built according to the following sketch:

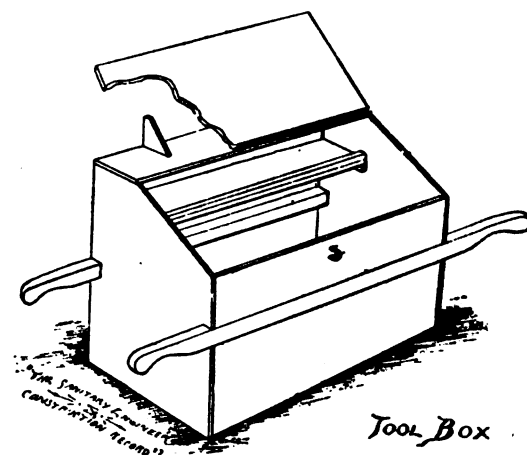


FIG. 2.

The same carpenter who makes the boxes can make also a derrick after the sketch given in Fig. 3, which will be found strong enough for pipes weighing a ton and easy to handle as soon as three men get the knack of carrying it.

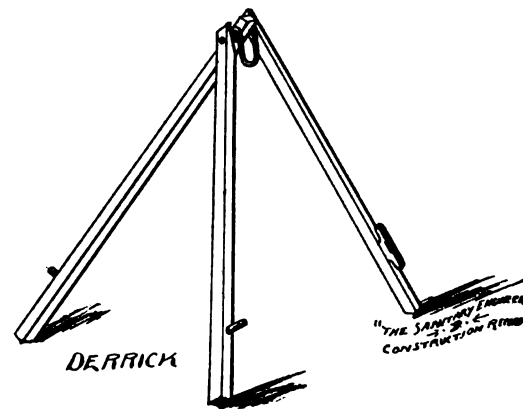


FIG. 3.

This should be made of straight-grained 4x4 sticks, 14 $\frac{1}{2}$ feet long, held together at the top by a 1-inch bolt. The link of $\frac{3}{8}$ round iron drops one foot, and $\frac{3}{8}$ carriage-bolts should be put through the end of the sticks to keep them from splitting. The large cleat on the right is to be bolted on with two $\frac{3}{8}$ carriage-bolts about 20 inches from the bottom of the leg, and a hard-wood pin driven in about the same distance from the bottom of each of the other legs. For pipes larger than 20 inches a 4-leg derrick with a windlass may be found more convenient.

For 6-inch pipe two 8-inch double blocks will give power enough, but for 16-inch a quadruple and triple block in combination will be needed.

The number of picks and shovels required depends, of course, upon the number of men that are to be employed. One shovel to a man is enough, but if the digging is likely to be hard double the number of picks will not be too many, to allow time for sharpening. A shovel with a welded strap does better work than one in which the strap is riveted, and for anything but scraping up from a platform, a round point is better than a square point.

Provide three, four, or half a dozen steel crowbars 5 $\frac{1}{2}$ to 6 feet long, 2 or 3 sledges weighing say 10, 15, and 20 pounds, and 2 tunneling bars, if the digging will permit of this sort of work. The tunneling bars are easily made by welding on to a piece of 1-inch pipe 8 or 10 feet long a chisel-shaped piece of steel 2 or 3 inches wide.

For ledge-work, drills made of $1\frac{1}{4}$ -inch octagon steel, forged to cut a $1\frac{1}{4}$ -inch hole, with sledges weighing 6 to



CARRYING
STICK-HARD WOOD
4x4

FIG. 4.

8 pounds, and a spoon for scooping out the dust and drillings, will be required.

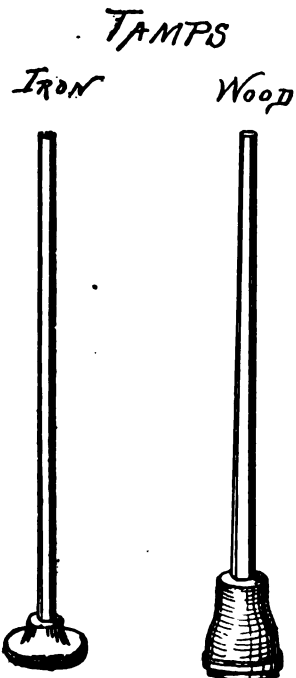


FIG. 5.

Carrying sticks for lifting 4, 6, and 8 inch pipe, of the shape shown in the sketch Fig. 4, are useful; larger sizes of pipe are handled more easily by rolling.



CUTTING OFF TOOL

FIG. 6.

Skids 6 feet long of 2x4, 4x4, or of 4x6 spruce, according to the weight of the pipe, will be needed to throw across the trench.

When water is not available for back-filling some kind of tamp will be needed, and sketches of two patterns are given herewith, Fig. 5.

If any considerable amount of rock-work is expected, either as ledge or boulders, a second derrick will be needed, with some spare rope and a few pieces of chain.

For cutting cast-iron pipe provide two or three long-handled chisels, such as blacksmiths use for cutting off cold iron, and a pair of light sledges or striking hammers. For cutting wrought-iron pipe boiler makers' chisels and hammers are the proper tools.

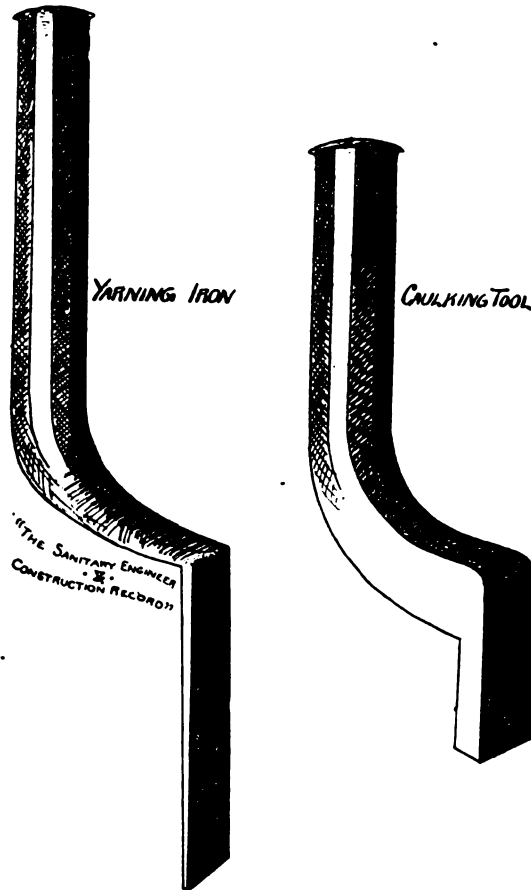


FIG. 7.

For making lead joints in cast-iron pipe, yarning and calking tools and short-handled calking hammer. One yarning-iron and four calking tools varying in thickness from $\frac{1}{8}$ to $\frac{3}{8}$ of an inch make a convenient set.

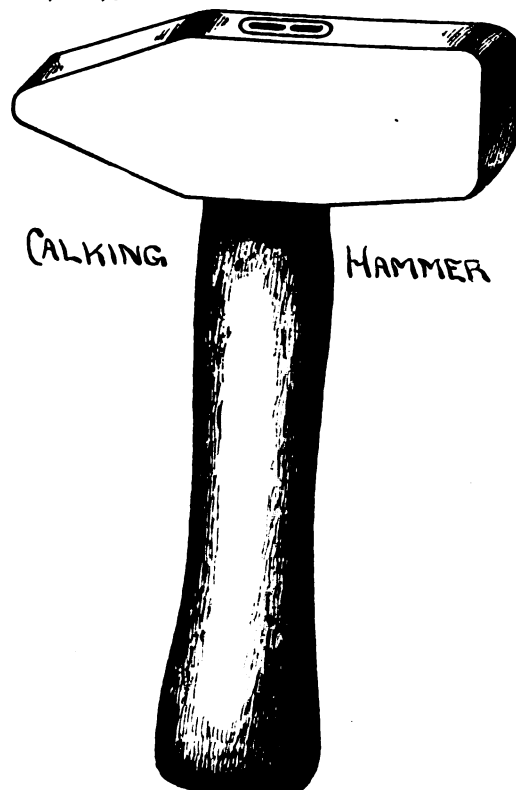


FIG. 8.

A furnace or lead-kettle of the pattern indicated in Fig. 9 is common among water-works' contractors. There should be a second door opening on to the grate at the point on the sketch where the shell is broken away to show the interior.

TRANSPORTATION.

Before the arrival of the pipe arrangements should be made to have men and teams ready to begin work at a few hours' notice; for, as a rule, vessel captains and railroad companies are in a hurry to be rid of their cargoes. Some trustworthy man should be selected to oversee the unloading and keep tally. In cast-iron pipe it is customary to mark the weight of each piece with white paint inside the bell, and if a memorandum is made of the weight of each piece as it leaves the car or vessels, the pipes will be counted and a check on the weight given in the bill of lading will be obtained.

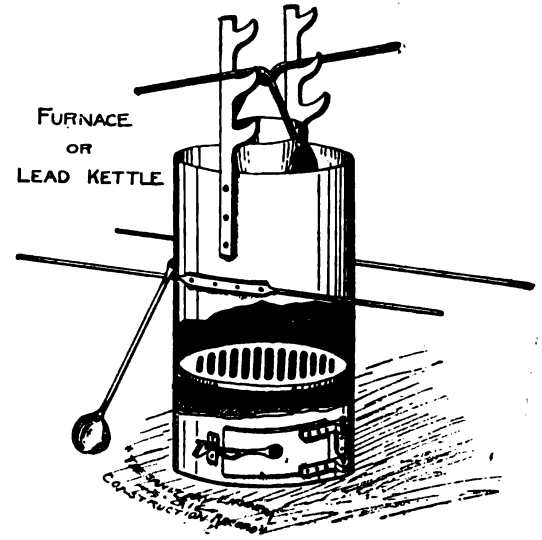


FIG. 9.

The pipes may be piled up on the wharf, or taken directly from the cars on to the drays or low gears that are to cart them. If they are to be put directly upon the drays, little or no blocking will be needed. Strong and careful men with carrying sticks, and some skids in the absence of a derrick, will soon discover the easiest method of handling the pipe and avoiding shocks and blows. If the pipe is coming out of a vessel and is to be piled up on the wharf, 2x4 spruce sticks in market lengths should be placed between the tiers, and strong skids used to roll the pipe from the deck ashore, and blocking be freely applied to prevent bunting, striking, or rolling. In the experience of the writer six active and fearless men easily took 16, 6, and 4-inch pipe from a vessel and piled it securely on a wharf faster than the crew could get it out of the hold with a steam-derrick.

In carting cast-iron pipe convenience and necessity will determine the kind of vehicle to be used, but in carting cement-lined pipe it is well to insist that the wagon shall have springs that the chances for cracking the cement lining may be reduced. The cost of carting must vary so much with circumstances that the writer can do no more than quote some figures from his own experience. Three bids were received in the spring of 1887 for carting an average distance of about two miles over good roads and streets with no steep grades.

680 tons of	125-lb.	16-inch pipe.
100 "	34-lb.	6-inch pipe.
100 "	20-lb.	4-inch pipe.
One of	\$1	per ton gross.
One of	67½	cents per ton gross.
One of	64	cents per ton gross.

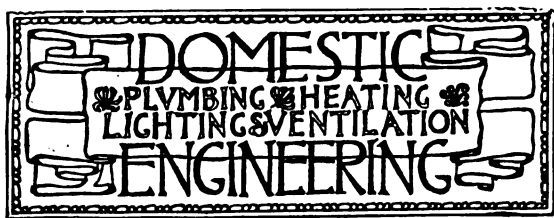
At this lowest figure the teamster appears to be satisfied that he is making a fair profit, but his horses and men are working hard for it.

When the town of Middleboro, Mass., constructed its water-works the writer was informed that the carting was done for fifty cents per ton, but the average hauls were short and the roads good.

Considerable judgment is required on the part of the teamsters who deliver the pipe on the street to distribute it so that it will not fall short or run over in laying, so that it will not cause excessive risk to night travelers while it is awaiting the coming of the workmen, so that it will not be in the way of entrances to private estates or of merchants whose teams wish to receive or discharge goods. If circumstances will permit, it will save time for the pipe-layers to have the pipe laid on the street with all the bells pointing one way, and that in the direction of the movement of the gang. This with reference to bell and spigot pipe; with other patterns this condition does not exist.

In directing the teamsters on which side of the street to deliver the pipe, consider on which side of the trench the bulk of the dirt is to be thrown and have the pipe dropped on the side opposite to that, and thus avoid having to lift the pipe over an embankment of loose earth.

(TO BE CONTINUED.)



HOT-WATER HEATING AND FITTING.

BY "THERMUS."

No. XII.

(Continued from page 435.)

HOW TO FIND THE SIZE OF RADIATORS AND COILS AND THE AMOUNT OF WATER THAT SHOULD PASS THROUGH THEM TO GIVE A CERTAIN DUTY.

BEFORE we can proceed to construct and settle the proper sizes for the mains and other pipes of a hot-water apparatus, we have first to determine the size of the radiators or coils that we must use and the quantity and the heat of the water that we must pass through them.

To keep a room warm by artificial means we must add as much heat to its walls and the air enclosed within them, through the medium of our radiators or coils, as is given off from the same room by the glass of its windows, its walls, the air admitted and extracted for ventilation, as well as the cooling done by accidental causes, such as leaky windows, doors, etc. In well-built houses the latter (or accidental factors) become small. In poorly-built ones they are often large, and in frame or wooden houses they are, as a general thing, greater than in brick houses.

To find the amount of radiator necessary to counteract the effect of windows and walls, it is necessary for us to have a good conception of the amount of heat lost through the windows and walls.

Heat from a room or building is lost by radiation, conduction, and convection. From a philosophical point of view, it would be a nice thing for us to know how the sum total of the heat lost is divided between these three methods of transmission, but for our purpose it is only necessary to know what the total amount is and how to find—at least approximately.

At low temperatures, or such as we are likely to have to deal with in hot water and air questions, the heat given off by radiation is less than that given off by convection and other causes. Above 400° Fah. the heat given off by radiation alone becomes greater, but of this we have nothing to do here, though when speaking on the matter of boilers it may be well to say something about it as bearing on their design.

Mr. Thomas Tredgold, C. E., in his work on "Warming and Ventilation," the third edition of which appeared in 1836, after his death, while speaking of the laws of cooling, says: "If the surface giving off heat be different at different times" (having different temperatures only, he undoubtedly means), "the heat given off in a given portion of time will be directly as the excess of temperature of the surface of the body giving off the heat in gaseous media, or in any fluid that is kept in motion."

This would be according to Sir Isaac Newton's theory of the law of cooling, and though later investigators (Petit, Dulong, and others) have demonstrated that this is not absolutely true for even low temperatures, and that at very high temperatures it is erroneous, we have, however, Dalton and Leslie as authority that for differences of temperature between mean temperature (40° Fah.) and 212° Fah. that it is correct enough for any ordinary purpose.

If we accept this, the quantity of heat given off will be directly as the surface and the difference of temperature between it and the media it is giving heat to. This, however, holds true only of surfaces of a like description against which the air can come in contact and rub freely at all points, such as flat windows, flat walls, and flat or vertical radiators; and by flat is meant surfaces that the air can come freely in contact with either as it rises or falls—one whose vertical plane is straight.

We are not far wrong, presumably, when we contrast for comparison the flat surface of a sheet-iron heater with the glass of a window, and taking the difference of temperature into consideration, and it was this W. J. Baldwin did when he adopted the empirical rule given on page 27 of "Steam-Heating for Buildings," which reads: "Divide the difference in temperature between that at which the room is to be kept and the coldest outside atmosphere by the difference between the temperature of the steam-pipes and that at which you wish to keep the room, and the product will be the square feet or fraction thereof of plate or pipe surface

that is the equivalent of each square foot of glass or its equivalent in transmitting power."

According to this rule, if we desire to keep a room at 70° Fah. when it is zero outside, with the temperature of the radiating-surface 212° Fah., we have

$$\frac{\text{Difference between temperature of room and outside temperature, } 70^{\circ} \text{ Fah.}}{\text{Difference between steam-pipes and air of room, } 142^{\circ} \text{ Fah.}} = .493 \text{ sq. ft.}$$

or say one-half a square foot of plate surface.

Now, practice has confirmed this rule as sufficiently near for practical purposes with ordinary good radiators, either in vertical or horizontal coil form, when the length of the vertical pipe or loop is not greater than 30 inches, and with horizontal coils of 1-inch pipe not higher than eight in number.

This, of course, is only an approximate rule for use in direct radiation alone, and, with a liberal addition of from one-quarter to one-half to provide for air admitted accidentally, has always proved sufficient in low-pressure steam-heating.

Of course the value of the walls, in addition to windows, as cooling surface must not be overlooked, and though we have only spoken here of glass, each 7 to 12 square feet of wall-surface, according to its nature, will have a cooling power equal to a square foot of glass, and must be considered the same.

The above is the first and simplest way of finding direct radiation surface for rooms. The example taken, however, was for radiator surface at a temperature of 212°. This is too high a temperature for low pressure for hot-water practice, and the writer, in his own practice in designing for hot-water apparatus, prefers to make his figures on the basis that the water in the coils or heaters of the apparatus has a temperature of 140° Fah., and that the outside temperature is 30°, or just below the freezing-point; then, as the temperature outside goes down, to increase the temperature of the water in the radiators or coils by keeping a stronger fire in the boiler. This gives us:

- (1) Temperature of air of room 70° Fah. — temperature outside 30° Fah. — 40° Fah.
- (2) Temperature of coils or heating surface, 140° Fah. — temperature of air of room, 70° Fah. — 70° Fah.

(3) $\frac{40^{\circ}}{70^{\circ}} = .571$ as the part of a square foot of heating surface at 140° Fah. that will contract the cooling done by one square foot of glass or its equivalent under average circumstances when the outside air is 30° Fah. Of course, to make this a scientific equation, the relative velocities of air-currents would have to be taken into consideration, which would bring wind velocities into the question. That would so complicate matters—and that unnecessarily—that no attempt will be made to do so, as with a hot-water apparatus under increased wind velocities, we have the same means of increasing the efficiency of our surface as we do under a lowering of temperature—namely, the increase of temperature of our water within the limits of our initial coil temperature (say 140° Fah.), and our maximum 212° Fah. or the steam-making point under our atmosphere; which gives us a reasonable range of temperatures that is sufficient to carry us down to a temperature of about 10° below zero outside.

The following columns show approximately the increase of temperature of the surface to the decrease in outside temperatures, increased wind velocities not considered:

Temperature of surface.	Temperature outside.	Ratio of heating surface in sq. ft. to a sq. foot of glass.
140° Fah.	30° Fah.	.571
157° Fah.	20° Fah.	.57
175° Fah.	10° Fah.	.57
192° Fah.	0° Fah.	.57
210° Fah.	10° below.	.57

This gives us the same ratio of hot-water surface as we would have of steam surface figured for the same conditions, and there is no good reason why we should use more surface for hot water than we should for steam, the surfaces having the same temperature. In "Steam-Heating for Buildings" the ratio is .49, because it was assumed the temperature outside was zero Fah. and the temperature of the pipe 212° Fah.; but here the calculations are based on the assumption that the air outside is 10° below zero, so that for low temperatures in the coils the surface may be a little more efficient.

To this ratio of .57 square foot of pipe or plate surface to one of glass or its equivalent of wall surface, from $\frac{1}{4}$ to $\frac{1}{2}$ more should be provided for warming air accidentally admitted and for loss of heat by sources other than the walls and windows, and the addition must depend on the character of the building and the judgment and experience of the designer.

Roughly, then, a building will require a ratio of plate or pipe surface of from .70 to .85 to one of glass at the temperatures given in the first column in the table to maintain them at 70° Fah. by direct radiation when the air outside is of the temperatures given in the second column.

Mr. Thomas Tredgold, early in the present century, considered the question of loss of heat from heated surfaces in a very thorough manner, and later he was followed by Mr. Charles Hood on the same subject, both having the same object in view—namely, to find the value of radiating surfaces for warming buildings.

Mr. Tredgold found that 2.19 pounds of water cooled from 180° to 150° Fah. in a vertical tin cylinder in 46 minutes, the exposed sides of which was 79 square inches, when the temperature of the room was maintained at 55½° Fah. during the trial. This gave a mean difference between the air of the room and the surface of the cylinder of 109.5° Fah.

From this we have 2.19 pounds of water cooled 30° Fah. by $\frac{79}{144}$ of a square foot of surface in 46 minutes of time, which = 65.7 heat-units for the time, or 85.7 heat-units for an hour of time, and 156.21 heat-units as what would be given off by one entire square foot of the same surface (tin cylinder) in an hour of time. This total heat, for a square foot of surface, for an hour of time, then, divided by the mean difference of temperature (109.5° Fah.) between the air and the surface of the cylinder = 1.42 heat-units; the amount given off per square foot of surface per degree difference of temperature.

His second experiment was with a glass cylinder that held 2.125 lbs. of water and had a surface of 71 square inches. It cooled from 180° to 150° Fah. in 31½ minutes in a temperature of 56½° Fah., which, by the same method of reasoning as we used before, gives 2.248 heat-units per hour per square foot of surface per degree (Fah.) difference.

His third experiment was with a sheet-iron cylinder—the surface being that of new sheet-iron unpainted—whose surface was 76.7 square inches, holding 2.14 lbs. of water and cooled from 180° to 150° Fah. in 29 minutes, the temperature of the air of the room being 57° Fah. By the same reasoning and method of calculation used in the foregoing examples we can find that the sheet-iron gave off 2.35 heat-units per hour per square foot of surface per degree difference of temperature.

These cylinders were as nearly alike as they could be obtained in form and size and one cover fitted all. They were suspended by cotton threads, so little or no heat could be lost by conduction or contact, and the sides and bottoms were exposed to the action of the air, etc. The top was covered by about one inch in thickness of alternate folds of cotton and flannel, so that the loss of heat by this direction was very small.

A few days later when the experiments were repeated the iron cylinder had become rusted. This Mr. Tredgold says increased its efficiency in the proportion of 156 and 180; the rusted cylinder having the latter value when the new one had the former. The experiments with the tin are of no value to us except to show that bright surfaces have a less value than dull or slightly roughened ones. Experiments with brass, etc., by other experimenters confirm this. The relative values of glass and iron, however, are of some value to us as showing how nearly they agree: the iron being the better of the two, even when new and bright, and increasing in value as it becomes rusty.

It would be well to remark here that probably when surfaces become dusty, which they will in practical heating, they may deteriorate somewhat, and that it would be well to assume that what they may increase in efficiency by rusting will be offset by accumulations of dust, etc., in most cases.

The form of Mr. Tredgold's cylinders—short, vertical ones—are presumably the best that can be devised for giving off heat. The same cylinders in a horizontal position would probably be found to be a little less efficient, and if they were to be increased in height, say two or three times, though used in a vertical position, it is only reasonable to suppose they would do less duty, for the very simple reason that the air in contact with the upper parts

has been warmed somewhat by the lower part as it passes upward, and, therefore, is not capable of extracting as much heat. The same holds good of horizontal cylinders when placed one above the other; each successive one, counting from the bottom upwards, does less work than the one next below it.

According to the above relative values, therefore, of glass and iron the empirical rule given above for finding heating surfaces by the window area, etc., is not without some scientific pretence, as the loss of heat through the glass of a window can rarely, if at all, be greater than through the iron of the heaters for equal difference in temperatures or for proportional differences.*

(TO BE CONTINUED.)

TO HEAT A CONSERVATORY BY HOT WATER, UTILIZING HOT-AIR FURNACE HEAT.

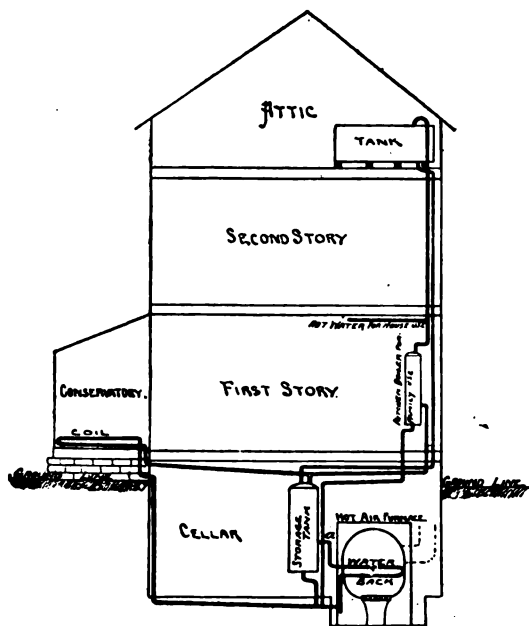
LA CROSSE, WIS., September 9, 1887.

SIR: I have a customer who wishes me to heat a conservatory with hot-water circulation-pipes, the heat being obtained by a coil around the outside of a Boynton hot-air furnace located in the basement; the conservatory is on the first floor. He also wishes a 50-gallon boiler connected with the circulation-pipe, and also with the hot-water boiler in the kitchen, so that hot water for house use can be drawn from both, thus increasing the amount of hot water that can be drawn at one time.

The kitchen-boiler is about thirty feet away from the conservatory and the furnace is about midway between the two, and in basement below. Kitchen-boiler is supplied from tank in attic. I enclose a sketch of the manner in which I propose to do the work and would like your opinion on it, and also any suggestions in the way of improvement, it being a new field for me. Please let me hear from you soon, and oblige an old subscriber.

Yours truly, W. P. POWERS.

[There appears very little objection to the method you propose and show, and its working depends entirely on the diameters of the pipes and the amount of coil in the water-back. Use not less than a 1-inch pipe in the coil in the conservatory, and if the coil and pipes are over 100 feet long from storage-tank to end and return, make all 1 1/4-



inch pipe, and carefully ream the ends in any case. Instead of taking a single flow-pipe from the head of the storage-tank and dividing or branching it to both kitchen-boiler and coil, it would probably be better to take a branch from the water-back pipe at *a*. This will give you hot water earlier and presumably hotter in the coil, but it has this disadvantage: should the furnace fire get low or go out you would not have the advantage of the circulation that would go on from the storage-tank after the fire went down. The storage-tank and all the pipes, of course, should be well covered to prevent the loss of heat.

As air will accumulate in the coil at the highest point, either a small air-chamber and pet-cock should be applied, or a small pipe run above the house-tank similar to what you show from the kitchen-boiler pipes.]

*I do not draw the same deductions from Mr. Tredgold's experiments that he does himself, and, therefore, did not give his figures here, but substituted my own in the manner recently shown; the summary of the matter being that the heat lost through glass would be 2.248 H. U., when that lost through iron would be 2.35 H. U.

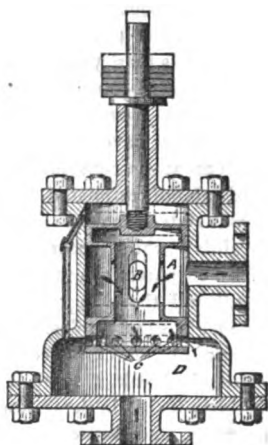
Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

REDUCING-VALVE.

THE illustration presented herewith is a section of a new and novel form of pressure-reducing valve, the invention of Mr. Richard H. Mather, of Windsor, Conn. There are no levers or diaphragms used in this valve, Mr. Mather having evidently tried in his valve to reduce to the minimum number of parts. The valve is intended for steam or other fluids, but for the purposes of description we will treat it as being used on a steam-pipe.

The device consists of a balanced piston-valve having a hollow top and bottom head connected by a hollow neck. The ends of the piston are closed, but the neck has several large ports located midway between the heads, and numerous small ports are located as near to the bottom of the lower piston-head as possible. To the top of the piston is attached the valve-rod, which passes out through a long sleeve formed on top cover of cylinder, and which fits the rod so nicely as to be steam-tight and yet allow of free longitudinal motion. On the stem near the top is a collar serving a twofold purpose—that of limiting the travel of the valve inwards and also to carry the weights, which are in the form of rings and can be put on or off as required. The outer casing or body of valve is cylindrical in form, being enlarged at the bottom to allow the steam to clear the valve when in the position shown; the upper part being bored true to fit the piston-valve just described.



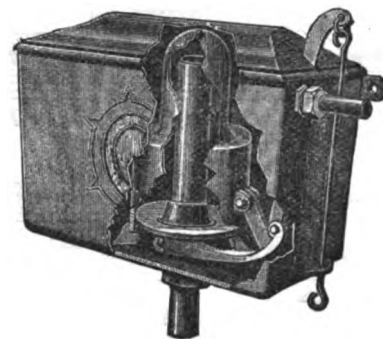
When in use the valve is connected by the neck shown on the right-hand side of casing to the source of supply, the distributing pipes being attached to the neck on the bottom head. The mode of operation is as follows: When not in use the piston is depressed by the weights to the position shown in the drawing. Steam under pressure being admitted to the cylinder part A, between the two piston-heads, enters the hollow interior of piston by the ports B and escapes by the ports C into the chamber D and thence through the distributing pipes. The chambers above and below the pistons are maintained at a uniform pressure by means of the equalizing-pipe shown on the left side of drawing. It must be observed that the bottom area of piston exceeds the top area of the same by an area equal to a cross-section of the valve-rod; therefore, so long as the pressure in the top and bottom chambers does not rise to such a point that the difference between the aggregate upward pressure upon the bottom of piston and the aggregate downward pressure upon the relatively smaller top of the same is equal to the weight of the piston, valve-rods and weights, the position shown will be maintained; but when the pressure in the chambers rises above the point described, the excessive upward pressure upon the piston raises the same toward the position indicated by the dotted lines, carrying the ports C within the close-fitting portion of the casing and cutting off the steam, hence the pressure on chamber D cannot rise beyond the point described. When the pressure in D again falls below that point the piston is forced down by the action of gravitation, opening the ports and immediately restoring normal pressure from the interior of the pipe. The degree of pressure within the chambers is

by increasing or diminishing the weight on top of valve-rod; the equalizing-pipe is so small that any considerable quantity of steam or other fluid cannot pass suddenly between the top and bottom chambers, and, for this reason, the automatic adjustments described are made by gradual and steady movements.

THE "WAVE" SYPHON WASTE-PREVENTING CISTERN.

THE illustration shows a new form of syphon cistern, the feature of which is the method of starting the syphon. The syphon is of the annular type, surmounted by a fixed bell or cylinder. The inner leg is provided with a collared flange traveling free upon it and acting as a piston or riser.

This flange, piston or riser is actuated by the forked bell-crank lever through the medium of a rod connected with the chain and pull handle. A pull on the chain causes



the flange to rise on the leg and thereby start the flow of the water over the top. It is claimed that the cistern is a perfect waste-preventer, as the inner leg of the syphon rises above the top edge of the cistern and will not therefore afford a waste for the water should the overflow-pipe become stopped.

The manufacturers are Messrs. George Farmiloe & Sons, 34 St. John Street, West Smithfield, London, Eng.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
September 17.....	19.82	21.09	21.95	27.74	26.92	21.85	28.57

E. G. LOVE, Ph.D., Gas Examiner.

THE Municipal Council of Paris has passed an ordinance that all theatres must substitute electric-light for gas within three months, must enlarge the lobbies and passages in accordance with the regulations of the Prefecture of Police, and put in iron curtains.

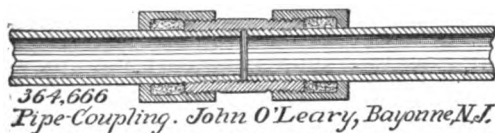
ELECTRIC-LIGHT has been introduced with great success in the Vienna Opera House. The generating station is at a considerable distance, and to overcome this difficulty four large storage-batteries have been placed in the vaults of the building, taking off the current at four points, so that at no point need tension or electrical pressure be any higher than that which has been usual in lighting ordinary houses. The same system is to be applied to all the theatres, public buildings, and large palaces in central Vienna.—*The Architect*.

A CHICAGO inventor has taken out a patent for a method of making impervious the joints of the lead pipe of electric cables, and assigned it to the Western Electric Company, same place.

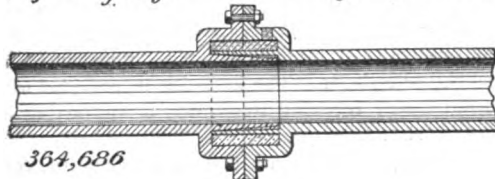
We are of the opinion that a better way to make wiped joints on lead pipe is to use solder of the proper degree of fineness, and to employ a plumber to do the work that knows how to wipe properly. Joints that will withstand 100 pounds of water-pressure can be made this way, and require no "doaping."

NOVEL PIPE-JOINTS OR COUPLINGS FOR NATURAL-GAS.

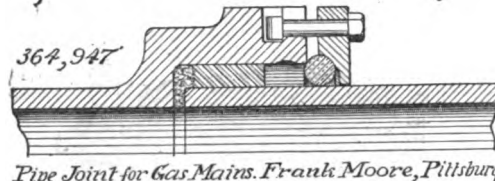
THE recent interest manifested by many patents issued for joints for cast or wrought iron pipe that will withstand high pressure such as is encountered in the conveyance of natural-gas from the wells, induces us to present,



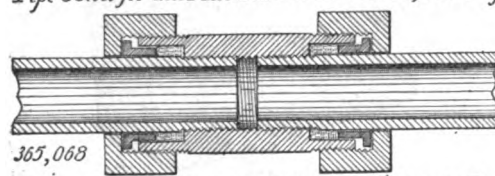
364,666
Pipe Coupling. John O'Leary, Bayonne, N.J.



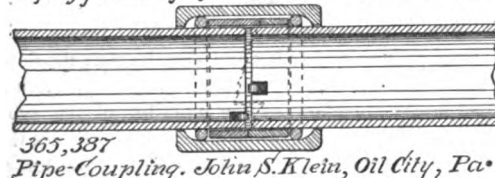
364,686
Pipe Joint. John J. Thomas, Pittsburg, Pa.



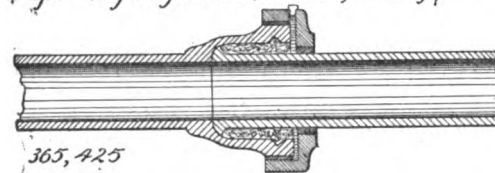
364,947
Pipe Joint for Gas Mains. Frank Moore, Pittsburg, Pa.



365,068
Coupling for Joining Pipes. Eli E. Hendrick, Carbonate, Pa.



365,387
Pipe Coupling. John S. Klein, Oil City, Pa.



365,425
Pipe Joint. William C. Barclay, Wellsburg, W. Va.

without comment, the following drawings of the inventions, their numbers, and the names of the inventors, as selected from two recent issues of the Official Gazette of the United States Patent Office.

TO PUT DOWN SCREW-PILES.

THE address of Captain K. Korow, 233 Eckford Street, Greenpoint, Brooklyn, N. Y., to put down screw-piles. He has worked under U. S. Engineer officers.

ARCHITECTURAL LEAGUE COMPETITION.

THE Architectural League has instituted an annual competition, open to "any one under the age of twenty-five and resident in the United States." The prizes are to be gold and silver medals, known as the medals of the Architectural League. The drawings will be exhibited at the annual exhibition and judged by a jury appointed for the purpose. The programme will appear in an early issue.

BOSTON SOCIETY CIVIL ENGINEERS.

THE regular monthly meeting of the Boston Society of Civil Engineers was held at the society's room, Wednesday evening, September 21, after an intermission of two months.

Twenty-five members, two visitors present.

Mr. Frank W. Hodgdon read a paper entitled, "A Short Description of the Methods of Filling South Boston Flats."

Mr. Charles W. Folsom made some remarks on a wash-out at Arlington, on the Boston and Lowell Railroad.

NEW ENGLAND WATER-WORKS ASSOCIATION.

THE fall meeting of this society was a genuine outing, and no business was attempted, except the election of four new members.

The party numbering 38, with 13 ladies, left Boston on the morning of the 14th inst., and a few hours later took

the steamer "Mt. Washington" for a delightful sail across the lovely Lake Winnepesaukee—Smile of the Great Spirit, in the Indian tongue. President Darling presided at the brief meeting held in the steamer's cabin, and the following gentlemen were elected members of the association:

Active Resident.—Charles H. Swan, C. E., Boston, Mass.; Sylvanus D. Horton, Secretary, Pawtucket, R. I.; Charles E. Prevel, Superintendent, East Providence, R. I.

Non-Resident Active.—Joseph A. Lockwood, Yonkers, N. Y.

Dinner was served on board and was appreciated, as it deserved to be. A short stay at Centre Harbor and the return sail across the placid lake, beautiful with afternoon shadows from Rattlesnake Island, finished the excursion, and the party rolled into the Boston and Maine station about 8 P. M., well assured that the day had been a pleasant one.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

SECOND fall meeting was held September 21, W. H. Paine, Past Vice-President, in the chair. Written discussions on "Excessive Rainfall" and on the "Kentucky and Indiana Bridge" were presented and read by the Secretary.

Discussion of paper of Captain R. L. Hoxie on "Excessive Rainfall," by S. Whinney. At Somerset, Ky., about noon of August 12, 1886, a sudden downpour of rain occurred, accompanied by sudden shifting winds and lightning. Duration of shower, thirty minutes, with a total rainfall of 1.57 inches. Estimated that three-fourths fell in twenty minutes. At the same place on August 27, 1886, about 3 P. M. the rainfall in forty-five minutes was 1.18 inches, and fully $\frac{8}{10}$ of the amount fell within thirty minutes. During the night of May 7, 1882, a rainstorm occurred in south-eastern Mississippi. A stream called Rocky Creek, two miles south of Ellisville, Jones County, with a drainage area of about fifteen square miles, rose to a flood cross-section of about 4,700 square feet. Its velocity could not have been less than $3\frac{1}{2}$ feet per second, giving a discharge of about 16,500 cubic feet per second. If two-thirds of the water falling reached the creek, the rainfall must have been two and one-half inches per hour. This storm continued for six hours, and the total depth of rainfall, estimated from most reliable data obtainable, was sixteen inches. J. Foster Flagg made a statement of rainfall which occurred on the Caribbee Islands in 1885, which partook, apparently, of the nature of "cloud-bursts," and the extent of this rainfall estimated to be six to eight square miles. But little rain fell during the evening of the night it occurred before 10 or 11 P. M., and before daybreak, 5 A. M., it was all over.

A sugar-tank, thirty inches in depth, was found running over in the morning, and known to have been empty before the storm. The total estimated depth was thirty-six inches. Its destructive effects upon the little town of Basse Terre, the capital of the island, strongly corroborates the estimated rainfall. The town is built on a plain along the shore, having a slight slope upward from the sea, with no semblance of a hill or valley on either side of the town, except in the rear, where Monkey Hill very abruptly rises to an altitude of 1,150 feet. The island has an area of sixty-eight square miles, and only five or six square miles drain in the direction of this town. Notwithstanding the shortness of the street, they were filled in places with a torrent over eight feet deep, and more than two hundred persons were drowned, a large number being carried out to sea. This torrent brought with it a large amount of detritus, and the northern half of a public garden, 450 feet square, was filled with mud to a depth of four or five feet, and water six or eight feet deep. The following morning a woman was dug out of the mud, who had been caught as she was attempting to cross the square, and buried upright as she stood. This square is only 225 feet from open shore, with two streets thirty and thirty-three feet wide leading from it to the shore.

Mr. F. Collingwood contributed the following, prepared from reports of U. S. Signal Service reports, of an exceptionally large rainfall at Alexandria Rapids Parish, La., on June 16, 1886. During this storm the wind changed every forty-five or fifty minutes. The town was eight-tenths flooded, and some portions eight feet deep. The rainfall from 5 P. M., June 15, to 6:40 A. M., June 16, was 11.09 inches; from 6:40 A. M. to 8:45 A. M., 2.16 inches; from 8:45 A. M. to 12:50 P. M., 8.15 inches; total for the nineteen hours and fifty minutes, 21.40 inches.

Discussed also by Messrs. Davis and Andrews.

The next paper was a discussion of Mr. Moulton's paper on the Kentucky and Indiana Bridge, by J. W. Schaub. Oral discussion followed by Mr. Emery Cooper.

Additional subscription to building fund: Mr. F. H. Brendling, \$25.

AMERICAN INSTITUTE OF ARCHITECTS.

WELLES BUILDING, 18 BROADWAY,
NEW YORK, September 22, 1887. }

SIR: At a meeting of the Board of Trustees A. I. A., held yesterday afternoon, the following candidates were elected Fellows—viz:

M. L. Beers, D. H. Burnham, II. L. Gay, H. W. Hill, William Holabird, J. W. Root, S. V. Shipman, J. L. Silsbee, and A. Smith, all of Chicago; and the following were elected Associates:

Otis Dockstader, Elmira, N. Y.; Alfred F. Pashley, Chicago; George W. Bunting, Oscar D. Bohlen, R. P. Daggett, James B. Lizius, J. H. Scharn, Adolph Scherrer, all of Indianapolis, Ind., and Charles P. H. Gilbert, of New York City.

The societies of architects in Washington, D. C., and Indianapolis, Ind., were, on application, admitted as Chapters of the Institute.

The officers and members of the Washington Chapter are as follows:

J. L. Smithmeyer, President; W. M. Poindexter, Vice-President; Glenn Brown, Secretary; C. A. Didden, Treasurer.

Professional Members—J. L. Smithmeyer, F. A. I. A.; John Moser, F. A. I. A.; O. Von Nerta, A. A. I. A.; S. M. Howard, A. A. I. A.; W. M. Poindexter, A. A. I. A.; J. A. Henry Flemmer, J. R. Marshall, C. A. Didden, A. A. I. A.; Glenn Brown, F. A. I. A.; C. H. Reid, T. F. Schneider, A. A. I. A.; Robert Stead, William Kirkus, Jr., Henry H. Law, Paul Schultze, M. Adolph Cluss, F. A. I. A.; Joseph C. Hornblower, J. West Wagner, Will. A. Freret, Edward Clark, H. L. Page, H. H. Kendall.

The secretaries of the A. I. A., the W. A. A., the A. L. N. Y., and of each chapter of the Institute are *ex-officio* corresponding members.

The membership of the Indianapolis Chapter consist of the gentlemen just elected to associateship in the Institute, together with Mr. D. A. Bohlen, F. A. I. A., its President; Mr. Lizius being the Secretary.

Yours truly, A. J. BLOOR, Secretary.

CONCRETE WORK UNDER WATER.

THE *Bulletin de la Ceramique* has called attention to the process employed by M. Houde in concrete work under water. It was desired to make the concrete penetrate between stones driven into the bottom at irregular intervals, it being impossible under these circumstances to use ordinary caissons. A square tube of 16-inch sides of ordinary planks was so arranged that it touched the bottom, while its upper extremity rose about sixty inches above the surface of the water, being transportable along the length of the work. This tube served to convey the concrete to the desired spots. When the tube is being raised care must be taken that the upper surface of the concrete does not descend below the level of the water. Layers of about sixteen inches thickness can be laid without the slightest difficulty by this appliance. The entrance of water and consequent saturation of the concrete at the commencement of the operation can be prevented by the lower orifice of the tube being closed with a board kept in position by cords, the tube being let down in such a manner while being filled, that the surface of the concrete is always above the water-level. When the lower orifice is near the bottom the cords are removed. This system was used with marked success in the construction of the bridge over the Loire on the line from Blois to Romorantin, when each appliance laid about 2,000 cubic feet of concrete per day. —*The Engineer*.

PERSONAL.

LIEUTENANT THOMAS L. CASEY, U. S. Engineers, has been ordered for duty from San Francisco, Cal., to Newport, R. I.

PROFESSOR J. H. VAN AMRINGE, of Columbia College, has the sympathy of a large circle of friends in the affliction he has sustained by the recent drowning of his son, who was a member of the class of '89.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



For works for which proposals are requested see also the "Proposal Column," pages 449-453-455-456.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

FENTONVILLE, MICH.—Water-works will be built here.

WASHINGTON, GHO.—Water-works will be built here, as already reported. Address B. S. Irvin.

WINCHESTER, KY., will build water-works. J. L. Frazier and W. T. Attersall are committee.

SOUTH PITTSBURG, TENN.—In reference to this place, previously reported, a franchise for water-works has been given to Nashville and local parties. James L. Gaines will give further information.

NESS CITY, KAN.—Mr. R. Osborn writes, over date, of September 19: "The Council instructed the City Attorney to draw call for an election to vote bonds for water-works, and nothing was done on the water-works, as the Council had in view a chemical fire-engine, which should have been here before this. If the engine is not satisfactory at the trial, I think they will go ahead with the bond proposition."

TUSCOLA, ILL.—Mr. A. C. Seuss, City Clerk, writes that "the city authorities have given up the water-works improvement, on account of the provision in our State statute, which will allow an indebtedness only of five per cent. of the assessed valuation, and our assessment is only about \$300,000, so that we cannot create an indebtedness sufficient to construct the works."

FENTON, MICH.—Mr. C. L. Corrigan, Town President, informs us that they have not taken any steps as yet, and do not think they will this season, in regard to water-works.

MARINETTE, WIS.—Incorporated is the City Water Company, with a capital stock of \$200,000. The incorporators are C. M. Fairchild, A. C. Brown, and C. R. Johnston.

NEWCASTLE, CAL.—The Bear River Ditch Company has made preparations to supply, within the next two months, the middle, southern and western portions of Placer County with all the water required for irrigation, mining and milling purposes.

SAUGUS, MASS.—Our correspondent writes: "The town of Saugus have contracted with Goodhue & Birnie, of Springfield, Mass., to lay about 7 miles of wrought-iron cement-lined pipe, and will connect with the water system of the city of Lynn, having a contract with that city for supplying water."

LONDON, ONT.—Our correspondent writes: "Application will be made by the Municipal Council of the corporation of the city of London, at the next session of the Legislature of Ontario, for an act to authorize this corporation to give debentures for \$12,000 for extension of our water-works; also to amend the present act to authorize the corporation to compel citizens to pay for water service from the mains adjacent to their properties."

WINCHESTER, KY.—Over date of September 12 our correspondent writes: "W. A. Attersall and J. H. Fryer were appointed Committee of Council to report on advisability, and authorized to visit other towns and report as to different plans, etc."

MANKATO, MINN.—Our correspondent writes: "The city of Mankato is now constructing a reservoir with an elevation of about 230 feet, and connecting the same with 16-inch pipe, water for the same to be forced from flowing wells on a level with the city."

AUGUSTA, GEO.—Our correspondent writes: "We enlarged our water-works here in the early part of 1885. There is no further contemplation of improvement except the usual extension of mains, etc."

WEATHERFORD, TEX.—We have referred previously to proposed water-works here. Address Matt C. Cameron in regard to taking franchise for works. Immediate attention necessary.

ORLAND, CAL.—On September 11, city election, by a considerable majority, organized an irrigation district, and the necessary work will be done.

VICKSBURG, MISS.—S. R. Bullock & Co., of New York, will push the water-works here to completion.

GREELEY, COL., is still discussing water-works. Address the City Clerk.

WATER-WORKS are reported as projected in the following towns: Gaylord, Mich.; Lyons, Ill.; Templeton, Cal.; Norfolk, Neb.; Bellevue, Mich.; Tazewell Court-House, Va.; Worcester, N. Y.; contract let to Francis Leonard; Albany, Geo., by Jeter & Broadman; Salisbury, Md., by J. A. Cloud; Saugus, Mass., by Goodhue & Birnie; Morrisonville, Ill.; Milford, Del.

VALLEY FALLS, KAN.—Mr. H. D. Butts, City Clerk, writes: "We have advertised for bids to put in a system of water-works."

EVANSTON, ILL.—Our correspondent writes as to water-works at North Evanston: "There has been no definite action taken as yet in regard to supplying the northern part of this village (North Evanston) with water. The probabilities are that some action will be taken some time this fall."

AKRON, COL.—Our correspondent writes: "It is understood here that the Lincoln Land Co., headquarters at Lincoln, Neb., have under advisement the scheme of a system of water-works for Akron, but what steps they are taking in the matter we are not permitted to know."

COLUMBIA, MO.—Our correspondent writes: "We have advertised for bids for water-works in our town according to plans and specifications which we have had drawn up by a competent engineer. James C. Orr is City Engineer."

MCKENZIE, TENN.—In reference to reports about water-works here our correspondent writes: "I am sorry to inform you that there is no plan for water-works suggested or thought of in our town at present."

GRAND RAPIDS, MICH.—The Board of Public Works has awarded the contract for the construction of a sewer in Sherman Street to Joel Collins for \$12,800.

GLENS FALLS, N. Y.—A company of Glens Falls and Ticonderoga capitalists have purchased the water-power at Alice Falls, near Ausable Chasm, and will soon erect a large pulp mill and a paper mill. About \$75,000 will be invested in the works.

HINSDALE, ILL.—Incorporated is the Hinsdale Water-Supply Company; E. W. Perry, Eugene E. Crosby, G. W. Hinckley, incorporators.

FORT COLLINS, COL.—A petition signed by the property-owners in the city will be presented to the City Council at its next meeting, asking that immediate action be taken toward supplying a system of drainage and sewerage.

MANITOWOC, WIS.—We recently noted the progress of a movement for water-works here. On the 25th of October Emil Baesch, City Clerk, will open proposals for the work. There will be a stand-pipe (direct pressure), 12.3 miles of pipe (16 to 6-inch), and about 155 hydrants. The population is about 7,000. Bids should state (1) the annual rental for 135 hydrants; (2) charge for additional hydrants, and rates to consumers.

EASTON, MASS.—The construction of water-works is progressing rapidly. The well is sunk to the required depth, the foundation of the stand-pipe nearly all laid, about a mile of pipe is laid and two miles of the trenches are excavated. The contractor will lay a mile of pipe per week.

KAUKAUNA, WIS.—We have previously noted this town. On September 13 a resolution passed City Council authorizing the Water Committee to employ an engineer to prepare plans and specifications for the water-works plant.

TRENTON, N. J.—The Sanitary Committee has filed an estimate for extending the outlet sewer into the channel of the Delaware River. The cost is \$40,000.

OMAHA, NEB.—The Omaha Water-Works Company has bought out both the Stockyards and South Omaha Land Company's water-works plants at South Omaha. The stock yards and land company's system will still be held as only auxiliary to the system-in-chief until the completion of the new works at Florence.

CLARKVILLE, TENN.—It is reported that water-works will be built here.

LONG PINE, NEB.—Bids for constructing water-works on plans by A. A. Richardson, of Lincoln, Neb., consulting engineer, will be opened October 8.

CHICAGO.—Incorporated is the Shone Hydro-Pneumatic Sewerage and Water-Supply Company for executing works on the Shone system; incorporators, Urban H. Broughton, Edwin Notton, Chester B. Davis.

ISHPEMING, MICH.—Much sewer-work, estimated at \$50,000, will be done very soon. Address the City Engineer. The plans have been completed by Chester B. Davis, of Chicago.

SAN FRANCISCO, CAL.—Articles of incorporation of the Indio Land and Water Company have been filed to bore and excavate for water and dispose of the same. The capital is \$1,000,000, and the directors, who all reside in San Francisco, are as follows: Charles N. Shaw, George W. Durbrow, Charles E. Green, M. Hubbard, and Henry Durbrow.

SYCAMORE, ILL.—We have, in previous issues, noted that water-works would be built here. The plans have now been prepared by Chester B. Davis, C. E., of Chicago. The estimated cost is \$30,000.

NEGAUNEE, MICH.—Plans for the sewerage of this place have been prepared by Chester B. Davis, of Chicago.

SOMERVILLE, MASS.—A recommendation that \$20,000 be borrowed for water-works extensions is now considered by City Council.

SARATOGA, N. Y.—Proposals are wanted for furnishing iron water-mains. Address the Water Commissioners.

DECATUR, ALA.—At a meeting of council, September 20, the city and the Decatur Land Company entered into a contract with A. H. Howland and George A. Ellis, to build works with pumping-plant, stand-pipe, 20 miles of pipe and 20 hydrants. This contract abrogates that made last spring with Inman Brothers, of New York City, who are held not to have begun work within the specified time.

NEW ROCHELLE, N. Y.—The New Rochelle trustees have appropriated \$3,000 to defray the expense of preparing plans and specifications for the new \$100,000 sewer they have determined to build.

EASTPORT, ME.—The Selectmen of Eastport have contracted with the Eastport Water Company to provide a water-supply from Boyden Lake at \$4,000 per annum rental.

SAN DIEGO, CAL., wants proposals for the construction, complete, of 135,000 feet of sewer.

ALBANY, N. Y., will set 175 additional hydrants. Address the Fire Commissioners.

ALLENSTOWN, PA., wants a stand-pipe. See our Proposals.

PITTSBURG, PA.—A syndicate composed of B. F. Jones, of Jones & Laughlin, Congressman John Dailzell, Thomas and James Atterbury, and Mark W. Watson, of this city, have secured the Atterbury water-works system, and will make an offer to supply the city of Chicago with water.

CLEVELAND, O.—The Sewer Commission will have at its disposal \$4,000 to aid in the investigation of means to protect the river from pollution by sewage.

MILWAUKEE, WIS., will develop water-power on the "old mill site." Address the Town Clerk.

LOSTANT, ILL., will have a system of water-works.

PONTIAC, MICH.—A recent city election carried in favor of raising \$75,000 for water-works.

SKYMOOR, IND., will have water-works. Address bids to Henry Price, City Clerk.

MINNEAPOLIS, MINN.—City Engineer Rinker has furnished estimates for sewer-work and assessments for the next year. The total assessment is \$240,592.

TOPEKA, KAN.—The Arkansas City Land and Water-Power Company has been incorporated by C. K. Holliday, of Topeka, and others.

ATHOL, MASS.—The work on the sewerage system, provided by town meeting in July, is delayed by constitutional restrictions against increasing the town debt.

MINNEAPOLIS.—The Council Committee on water-works have favored putting in two pumps with a capacity of 15,000,000 at the new pumping station at Shingle Creek. Proposals for building the new station and furnishing the pumps are advertised for. See our Proposals.

CANNON FALLS, MINN.—Mr. J. A. Wilson, Village Recorder, writes: "We have contracted for cistern to hold 3,000 barrels of water on an elevation of 120 feet above town, to be supplied from a well operated by wind-mill alongside the cistern. Our main pipe is 8-inch. We have ordered that from St. Louis, and our hydrants, etc., from Detroit."

MOUNT VERNON, ILL.—Mr. Henry E. Ellis, City Clerk, writes: "The proposition to issue bonds in the sum of \$25,000 carried by 37 majority. A board of commissioners was appointed to have charge, and, at a meeting held September 16, the board organized by electing George H. Varnell President, and H. L. Ellis Secretary, and adjourned to meet again, after examining place of site and consultation with civil engineers."

BOONE, IOWA, will sink an artesian well.

GENESEO, ILL.—The artesian well was completed September 22; 25 additional blocks of water-mains will be laid at once.

HAYWARD, CAL.—Helbing & Donnelly have proposed to the Board of Trustees to construct water-works, if the town will pay \$3,200 per annum.

DAVENPORT, IOWA.—The Committee of the Board of Health has reported a plan for a system of sewerage. The State Legislature will be asked to pass a law permitting the city to make the needed outlay. The plan provides for a 6-inch or 4-inch outlet-sewer, with 18-inch and 24-inch pipe-sewer branches, the main to discharge some distance below the city. City Physician Cantwell, or City Attorney Fisher, will give further information.

FORT WAYNE, IND.—The City Council ordered the condemnation and purchase of the canal feeder for the purpose of supplying the city with water. S. C. Lumbard, H. C. Graffe, and J. L. Gruber were appointed Commissioners to have charge of the condemnation and purchase of the property, and will commence their work at once.

TUSCUMBIA, ALA.—All the stock of the Tuscumbia and East Sheffield Water-Works has been taken and the water from Big Spring will be distributed to the cities of Sheffield and East Sheffield.

BAY SHORE, L. I.—An agitation for sewerage has begun here.

LANSINGBURG, N. Y.—Engineer Franklin began on September 19, the preliminary survey relative to the practicability of gaining additional storage capacity for water on the premises on which the reservoirs are located.

STROMSBURG, NEB.—Our correspondent writes in regard to water-works here: "We vote on \$12,000 bonds on September 21. I think it will carry. We will furnish plans and specifications to any contractor. Address Mr. F. Fuller, City Clerk."

PAXTON, ILL., has let a contract for water works to Chicago parties.

OAKLAND, CAL.—The Board of Health has appointed a committee consisting of City Engineer Morgan and members of the board, to report on means to obtain a complete sewerage system.

DULUTH, MINN.—The Zenith Gas and Water Co. is incorporated, to supply Duluth with water from Lake Superior, and build gas works. The directors are: Prosper L. Knoppen, Dan. Pineo, of St. Paul; Henry H. Bell, of Duluth; G. G. Hartley, R. C. Mitchell, C. M. Parkhurst, all of Duluth.

RUSHVILLE, NEB., is agitating the introduction of a water-supply, with pumping-plant.

TARENTUM, PA.—The Tarentum Water Company was chartered September 21.

GLEN ELIHER, KAN.—Our correspondent writes: "As yet nothing has been done but talk. Perhaps next year water-works may be established here."

HAYWARD, WIS.—Our correspondent writes, under date of September 19: "We have decided to build the water-works ourselves, and one of the supervisors is going to St. Paul to see about pipes and other things that we need."

PAWNEE CITY, NEB.—Bids for constructing water-works here, plans by A. A. Richardson, of Lincoln, Neb., will be opened October 4.

PAWNEE CITY, NEB.—We have noted that A. A. Richardson, Consulting Engineer, of Lincoln, Neb., has prepared plans of water-works to be built here. Mr. Henry Cowperthwaite, City Engineer, writes us that bonds for \$28,500 have been voted. The specification calls for a pump with 1,000,000 gallons in 24 hours; a water-tower 12 feet in lineal diameter, 100 feet high; a masonry reservoir, and about 18,000 lineal feet of pipes, 4 to 10-inch, with the necessary castings. Bids will be opened on October 4. They should be addressed to J. M. Miller, City Clerk.

SAN DIEGO, CAL.—A land and water company to be known as the Barham Land and Water Company has been incorporated, with J. H. Dickey, C. L. Murray, R. W. McGarvie, J. P. Preston and John A. Fish as directors. The object of the company is to supply the town of Encinitas with water.

SHEFFIELD, ALA.—Address the East Sheffield Land Company about building water-works.

LOS ANGELES, CAL.—Mayor W. H. Workman has recommended to the City Council the holding of a city election on the question of raising \$750,000 for the sewerage system and \$150,000 for new parks. Both recommendations are referred to committees.

FOSTORIA, O., has decided to build water-works.

FREMONT, O., will enlarge its water-works.

NORTH PLATTE, NEB.—Our correspondent writes: "The American Water-Works and Guarantee Co. (Ltd.), of Muncie, Ind., have a twenty-five years' franchise to put in a system of water-supply for North Platte, Neb. A part of their material is now here."

BONHAM, TEX.—Our correspondent writes: "The City Council has a committee appointed now to confer with water-works builders and artesian well men on the subject of water-works for the city, and will determine in a short time what they will do."

BONHAM, TEX.—Address E. L. Agnew about the proposed water-works here. Immediate attention is necessary.

CARLINVILLE, ILL.—Under date of September 14 our correspondent writes: "An ordinance was adopted the 5th inst. letting the contract to construct water-works in our city to C. E. Gray, Jr., and associates, of Chicago, Ill. The works are to be constructed on franchise plan, and Gray and associates have sixty days from September 5 to accept. The ordinance will be published in the Carlinville Democrat and Macoupin County Enquirer this week. Both papers published in this city."

KROOK, IOWA.—Our correspondent writes: "There is no contemplation at present to enlarge the water-works in our city, and the old companies having possession originally have given up to an Eastern syndicate, but nothing is settled yet as to future business enlargements."

JACKSON, MISS.—wants water-works, and has started the movement to get them. The editor of the State Ledger is an active promoter of the enterprise.

WATERVILLE, N. Y.—George W. White, of Pulaski, has the contract for building the Waterville water-works. They are to be completed the latter part of December of this year.

ALBION, MICH., proposes to vote on the raising of \$50,000 for water-works. The City Clerk will give further information.

BENNINGTON, VT.—A syndicate of Bennington mill owners are to build a storage reservoir at Headley's novelty works for use during low water.

CLARKSBURG, W. VA.—The election on water-works by a large majority for works. Steps will be taken at once to make contracts; \$50,000 will be expended.

LAKE GENEVA, WIS.—The election on introducing water-works, recently held, went adversely to the proposition.

MANISTIQUE, MICH., will build larger water-works plant. Address the City Clerk.

LAKE, ILL.—The Town Trustees are asking for proposals for pumping-engines. See our Proposal columns.

ALBANY, N. Y.—The Water Commissioners are asking for bids on furnishing 6-inch or 8-inch cast-iron water-pipe. See our Proposals.

ST. IGNACE, MICH.—Our correspondent writes in regard to rumors about water-works here: "It is a little too soon for any information as regards water-works for this city; it's simply talk. Most of the business men are in favor of it, and there is some talk among the Aldermen of holding an election this fall and put it to a vote of the taxpayers, but nothing definite has been done yet."

GAS AND ELECTRIC-LIGHTING.

SAN JOSE, CAL.—The city has contracted with the Brush Electric-Light Company for electric street lights.

FINDLAY, O.—The City Gas Company took control September 19 of the Findlay Gas-Light Company's plant. The city gives its bonds in the sum of \$75,000 in payment.

PEKIN, ILL.—The electric-light station at Pekin was burned September 19. This accident leaves the city in darkness.

BREKLEY, CAL.—A meeting of citizens was held September 19 to incorporate the Berkeley Electric-Light Company. The plant will be constructed at once.

MARION, IOWA.—The electric-light people are still getting estimates from companies who wish to enter into a contract for putting in the plant here. The Edison and United States companies have put in bids for the work, and the Westinghouse Alternating System will also be presented.

GAS COMPANY.—In our Water Notes will be found the incorporation of a Gas and Water Company, at Duluth, Minn. Works will be built.

WOLCOTT, N. Y.—Natural gas has been struck here, and wells will be sunk and plant developed.

WASHINGTON, D. C.—The Washington Gas Company has taken out a permit to begin the work of erecting its new plant. The permit is for the erection of a retort-building to cost \$30,000, and an engine-house to cost \$20,000. When these are completed, two large gasometers will be erected.

WOODHAVEN, L. I.—The Woodhaven Gas-Light Company has been organized by the stockholders of the company doing business in East New York.

CHICAGO, ILL.—Incorporated September 16 was the Citizens' Natural Gas and Light Company; capital stock, \$1,000,000; incorporators, Joseph H. Livingston, C. W. Cray and John Moffit.

KINGSTON, ONT., is introducing electric-lights for the streets.

GREENVILLE, MASS.—The City Council has entered into a contract with the gas company to furnish the city with 25 lights at \$2.50 per month per light.

BLACK RIVER FALLS, WIS.—A gas company has been organized here with T. B. Mills, H. B. Cole, W. R. O'Hearn, of the Board of Directors.

FORT SMITH, ARK.—The Electric-Light Company, George Sagel, Secretary, has made a proposition to City Council to light the streets.

TRENTON, N. J.—The Common Council will receive at its meeting, October 4, proposals for furnishing electric incandescent lights, or lights by gas, naphtha, or other materials, to the city street lamps now lighted with gas.

ALLENTOWN, PA.—City Council at its meeting September 21, decided that during the next five years the streets of Allentown shall be lighted with 98 electric lights and 125 naphtha lamps, at a total cost of \$11,975 per annum.

CHICAGO.—Incorporated is the National Coke and Fuel Company; capital stock, \$600,000; for mining and manufacturing coal, coke, fuel, and illuminating gas, and the manufacture and distribution of gas and steam for power, heating and other purposes; incorporators, Columbus R. Cummings, James M. Flower, and George S. Willis.

AUSTIN, TEX.—The Westinghouse system of electric lighting will be introduced. Captain Molher is director, and C. F. Parmley superintendent of the work.

BAY CITY, MICH.—This city will have electric lights at \$77 per lamp per annum; contractors, the Bay City Electric-Light Company.

PAWNEE CITY, NEB.—A proposal has been made to City Council to establish a system of electric lights.

BRainerd.—The electric-light wires were placed September 16.

FORT WAYNE, IND.—A natural-gas-company will be organized by the Business Men's Exchange. Address Captain J. B. White.

CATSKILL, N. Y.—The Catskill Electric-Light Company, with a capital of \$20,000, was incorporated September 19 to manufacture electricity in Catskill for lighting the streets of Catskill and for heat or power.

CANASTOTA, N. Y.—No decision has yet been made on the electric-light question. The Village Trustees have received a bid from the American Company. They offer to put in 27 lights at \$75 each, yearly, and want franchise for five years. A company, organized by local capitalists, known as the Canastota Electric-Light Company, has offered to put in 32 lights at \$60 each, and they will probably be awarded the contract. They will use the Thomson-Houston system, and the street lights will be of 2,000-candle-power each.

PUEBLO, COL.—At a meeting of the City Council, September 12, a five-year contract with the Pueblo Electric-Light Company was entered into to light the business streets of the city by electricity. The lights will cost the city between \$4,000 and \$5,000 a year.

TOLEDO, O.—The Ohio and North-western Gas Company, of Toledo, increases stock to \$4,000,000 for enlargements.

HOPKINSVILLE, KY.—The Hopkinsville Natural-Gas Company has been incorporated; capital, \$50,000.

TUSCALOOSA, ALA.—The Tuscaloosa Coal and Iron Co. will erect a natural-gas plant.

LOUISVILLE, KY.—The Citizens' Electric-Light Company will at once erect a plant.

LAKE VIEW, ILL.—Incorporated is the Union Wave Light Company; John Hufmeyer, Hermann Koepper, and others.

TIFFIN, O.—Incorporated is the Co-operative Gas and Oil Company.

MARTINEZ, CAL.—Gas-works will soon be completed for street lighting.

CHICAGO, ILL.—Incorporated is the Lakeside Natural-Gas Company, of Chicago; incorporators, Loren H. Whitney, Rensselaer A. Palmer, and Daniel W. Albaugh.

FORT SCOTT, KAN.—The following notice is published: The Fort Scott Prospecting and Mining Company proposes sinking a 2,000-foot well in the gas-district. Propositions will be received for the location of the well until September 30. E. D. Marr, Secretary.

OCALA, FLA.—An electric-light plant will be constructed here by A. E. Waterman.

PALATKA, FLA.—Incorporated is the Southern Gas Trust and Construction Company.

OLIVER SPRINGS, TENN.—The Knoxville Natural-Gas Company has been incorporated. H. H. Taylor, President; Simon Burger, Secretary and Treasurer; E. A. Reed, Vice President and General Manager.

ANNISTON, ALA.—T. G. Foster & Co., of Montgomery, will build gas-works here.

MANCHESTER, VA.—A move is being made here to obtain electric-lights for the streets. Immediate attention is necessary.

FORT SMITH, ARK.—Chartered is the Fort Smith Natural-Gas and Power Co.; officers: Harry E. Kelley, President; J. Henry Carroll, Vice-President; Talbot Stillerman, Secretary; George T. Sparks, Treasurer; Harry E. Kelly, J. Henry Carroll, J. L. Tilly, William Breen, Henry Rentzel, L. W. Rains, and I. G. Fellner, directors.

BRIDGES.

CHICAGO.—For building the 18th Street viaduct, Chicago, over four railroads, the contract is let to the Keystone Bridge Co., of Pittsburg, for \$83,300, the construction being directed by City Engineer Artung-stall, and the bills paid by the contracting railroads, the Western Indiana, the Chicago and Alton, the Arch-chison and Topeka, and the Wisconsin Central. Only informal bids were received by the roads, other proposals being: The Pittsburg Bridge Co., for \$87,000; Detroit Bridge Co., \$95,000; Gotlieb, of Chicago, \$84,600; King Bridge Co., Cleveland, \$105,444.

ELIZABETH, PA.—A \$100,000 bridge will be built on the Monongahela River.

LINCOLN, NEB.—A city election last week defeated by a large majority the project of building the bridge which that city was to build jointly with North Platte.

TRENTON, N. J.—The Board of Freeholders on next Tuesday will consider the building of a bridge over Assanpink Creek.

DULUTH, MINN.—A bridge will be built over the Bay at Connors by the Burlington and Duluth, and the South Shore and Atlantic Railways.

DETROIT, MICH.—The Board of Public Works has received bids, as per proposals, for building the Presque Isle Bridge, and has recommended that the contract be awarded to the Milwaukee Bridge Company, at \$205,000. A special committee of the Board of Aldermen has the matter in consideration.

BOSTON.—The City Engineer has plans in preparation for an iron bridge over Charles River, and proposals will soon be asked for. It is to be built during the coming winter.

SINCLAIRVILLE, N. Y.—An iron railroad bridge will be built over Mill Creek, on Railroad Avenue. Address Commissioner Torrey.

ATLANTA, GEO.—An iron bridge will be built at Nelson Street crossing. Address Hon. C. A. Collier, Board of Aldermen.

NEWARK, N. J.—A strong movement is developed for a bridge over the Passaic River, in the Eighth Ward; estimated cost, \$75,000.

YANKTON, DAK.—A railroad bridge will be built over the Missouri River. The City Clerk will give information.

CHICAGO.—The double bridge at Madison Street has been decided upon. The plans contemplate a structure about 310 feet in length, to be swung from a pier located on the west bank of the river. The present viaduct will be supplanted by the coast end of the bridge.

COLUMBUS, NEB., will hold an election, October 17, to vote on raising \$30,000 for a bridge over the Loup and Platte Rivers.

MECHANICVILLE, N. Y.—Articles of association were signed September 17 for the organization of a corporation to be known as the Mechanicville Bridge Company, by George B. Perry, William W. Smith, George R. Moore, J. F. Terry, Stephen Lee, H. Medbery, and A. Bryan.

ROME, GEO.—Address the Board of Commissioners with proposals for building a bridge over the Oostanuala River.

FRONT ROYAL, VA.—Address M. L. Garrison here about several bridges to be built in Warren County.

AMERICUS, GEO.—Contract for trestles and bridge between Abbeville and McRae, Geo., has been given to A. R. Coulter, of this place.

WAXAHACHIE, TEX.—Bids for constructing twelve iron bridges will be received by the Commissioners' Court at this city.

KANSAS CITY, MO.—William B. Knight, Chief Engineer Kansas Railway Co., writes to correct a misstatement in a Construction Note item in our issue of September 10. Mr. Knight is building several bridges, "putting in stone culverts and masonry abutments with first-class plate-girder iron bridges instead of the present wooden trestles and structures at several points along the line in connection with the double track improvement along the road of the belt railway." The work is under Mr. Knight's personal charge.

MINNEAPOLIS, MINN.—The Council Committee on Roads and Bridges has awarded the contract for the superstructure of the Franklin Avenue Bridge to the King Bridge Company, the work to be finished by the 1st of June, 1888. The bid for the work was \$81,500.

HIGGANSUM, CONN.—The town will build several iron bridges.

VALLEY FALLS, R. I.—Engineer Cushing has prepared plans for the superstructure of the John Street Bridge. The masonry is already under contract. Estimated cost of superstructure, \$7,000. Address the Clerk of Town Council for further information.

WESTBOROUGH, MASS.—At the meeting September 28 a warrant providing for the building of a bridge over the Boston and Albany Railroad tracks will be considered.

WHEELING, PA.—The Chamber of Commerce is taking steps to have a "Union" railroad bridge built. Messrs. Tyler, Stein, and McGinley are of Committee.

ASBURY PARK, N. J.—Bids for a new bridge across the Manasquan River, between Manasquan and Burroughs, in Ocean County, will be received on September 27. The dimensions are 825 feet in length, with a draw 30 feet across, the bridge to have a roadway of 16 feet.

STEAM-HEATING, BUILDINGS, ETC.

BROOKLYN.—Charles Collins has received the contract for erecting a court house and police station at Lee Avenue and Clymer Street, at \$59,580. The work will be begun at once.

HASTINGS, MINN.—To-day an election will be held on the question of raising \$53,000 for an almshouse.

IRONWOOD, MICH.—A large amount of building will be done here at once to replace structures destroyed by fire. One of the firms to so rebuild is Bingham & Perrin, who may be addressed.

UTICA, N. Y.—The contract for improvements at the State Asylum for the Insane has been given to Charles Metz, of Utica.

TRENTON, N. J.—The lowest bidders on the proposed High School are: William Hunt, carpenter-work, \$4,730; J. W. Hooper, masonry, \$5,445.60. These bids include the steam-heating and plumbing.

SAN JOSE, CAL.—The Common Council, September 12, awarded the contract for erection of portion of the new City Hall to P. R. Welles for \$117,000.

FERGUS FALLS, MINN.—The Board of Trustees of the Insane Hospital have accepted the plans of Architect Dunnell. The building will cost about \$59,000. Specifications and proposals will be issued at once.

WINONA, MINN.—Bids for building a court-house were opened September 10 by the County Commissioners. The lowest was from Munck & Lohse, at \$105,400. It is reported all will be rejected and the plans modified.

YANKTON, DAK., is advertising for bids for the construction of a city hall.

CHICAGO.—Up to September 30 the Chicago Building Department has issued 3,008 permits, as against 2,725 for the same time last year, and the value of the buildings is \$4,000,000 more, including the \$2,000,000 Auditorium Building, now up to the second story.

FONDA, N. Y.—The contract for heating the Reformed Church with steam apparatus has been given to Pierce, Butler & Pierce, of Syracuse, at \$685.

COUNCIL BLUFFS, IA.—The contract for ventilating the Federal Building at Council Bluffs, Ia., has been awarded to William Kirkup & Son, of Cincinnati, at \$12,830.

ANTELOPE, NEB.—A city election will be held October 18 to raise \$12,000 for building a court-house.

STREET WORK AND PAVING.

SAN DIEGO, CAL.—The election September 5 on raising \$100,000 for improving county roads carried the proposition by a heavy majority. The County Supervisors will do the work.

PITTSBURGH, PA.—Orders have passed for much street-work, with sewers.

NEW ORLEANS, LA.—\$75,000 worth of gravel is advertised for to use on streets. Address the Comptroller.

ARKANSAS CITY, KAN.—Eight miles of macadamizing streets will be done here.

OAKLAND, CAL.—Contract for grading and curbing East 12th Street is given to E. J. Bates, lowest bidder. Address Clerk of Council, A. C. Henry, about much street-work which has been ordered done, on Cypress, Harrison, Hannah, 28th, and other streets.

ALAMEDA, CAL.—The opening and grading of several streets will be pushed. Address the City Clerk.

LITTLE ROCK, ARK.—Bids will be called for shortly for paving about eleven blocks of West Markham Street with Telford macadam.

ST. PAUL.—The Board of Public Works opened bids for paving Mississippi Street as follows: James Forristal, \$22,700, and sewer connections, \$50; Thornton & Shaw, \$25,000; Isaac Robinson, \$21,687, and \$40 for sewer connections; Folsom & Murray, \$24,000, and \$55 for sewer connections; H. B. Sweet, \$18,900, and \$36 for sewer connections. The contract was awarded to H. B. Sweet.

CINCINNATI.—Contracts for improvement of Pearl and Walnut Streets with granite, and Fern Street by macadamizing, have been awarded. For the first named job G. Everman & Co. were successful, their bid of \$50,074.50 being the lowest. F. Kirchner & Co. obtained the Pearl street job, bidding \$30,568.50. Kirchner will use Marlboro and Eyerman Lithonia granite.

LAKE VIEW, ILL.—The Board of Aldermen have appropriated \$21,000 to the improvement of Fullerton Avenue and other streets.

TROY, N. Y.—The Board of Contract is considering the paving of Fifth Avenue, at a cost of \$40,000. The Board holds that the work must be done.

LOWELL, MASS.—\$30,000 will be applied to street and bridge work. Alderman H. M. Fletcher will give further information.

MACON, GEO.—City Council has ordered the appropriation of \$60,000 to street improvements.

ALEXANDRIA, VA.—An expensive project is on foot for construction of a Grand Avenue, 100 feet wide, from Mt. Vernon to Washington. Mayor Smool, of Alexandria, is interested. A committee will report on organization and steps to prosecute the work.

BALTIMORE, MD.—Bids are opened to-day (September 24) by W. H. Shipley, 219 East Fayette Street, for improving Cedar Avenue. The amount of gradation will be about 53,000 cubic yards and about 1,500 perches of masonry.

LITTLE ROCK, ARK.—The Commissioners of Sidewalk District No. 4 are advertising for bids for about one mile of brick sidewalk. R. A. Edgerton, President.

RAILROADS, CANALS, ETC.

CALIFORNIA RAILROADS.—On September 12 there were incorporated the Santa Monica Outlook Railroad Company; directors, Abbot Kinney, Patrick Robertson, James Bettner, D. Galbraith, W. P. Gardiner. The road is to run from Santa Monica to the ocean beach. Los Angeles and Ocean Railway; directors, C. E. French, E. Bouton, M. L. Wicks, Jotham Bixby, Edward Records, John W. Green, A. W. Barrett, A. W. Francisco. The Wilderson Station Tract Land and Water Company; directors, W. H. Bonnell, Theodore

Wiesendanger, Clifford Evans, Van K. Dronillard, and Arthur M. Jones. The Pasadena, Los Angeles and Long Beach Railroad Company; to construct a railway from Pasadena to Long Beach; directors, John W. Green, O. J. Johnson, F. A. Atwater, William Walter Ross, G. W. Glover, Jr.

KNOXVILLE, TENN.—Articles of incorporation of the Knoxville Belt Line Railway have been filed in Hudson County, N. J., to construct railways in Tennessee. George R. Eager, A. C. Arthur, Clarence Cary, and others.

EUFULA, ALA.—The Eufaula and East Alabama Railroad will be built to Ozark. The Georgia Central will build it, and contracts will be let at once.

NAPA, CAL.—The Napa, Lake and Humboldt Railroad will be built at once.

SACRAMENTO, CAL.—The Atlantic and Pacific Railroad Company will build to Sacramento from Mojave. Surveyors are now on the line.

AUGUSTA, GEO.—Plans and specifications will be prepared by the City Engineer for the proposed levee. Dr. Eugene Foster, of the Board of Health, will give information.

WINONA, MINN.—The plans for the construction of the Winona and South-western Railway are about ready. The contract with Messrs. Hatch & McIntyre is nearly completed, and those gentlemen have negotiations completed for the purchase of the Mason City and Fort Dodge Railway as soon as they get the contract.

RAILROAD.—The Sackem and Western Air Line Railroad will build from Shelby to Cranberry, N. C. Address S. T. Pearson, Morganton, N. C.

MURFREESBORO, N. C.—Chartered is the Murfreesboro Railroad, B. B. Winborne, President.

RAILROAD.—The Lexington, Geo., Terminal Road will extend from Crawford, to intersect the projected Augusta and Chattanooga Railroad. Address Hamilton McWhirter.

GATE CITY, ALA.—Address the Gate City Land Company about a road to be built from Gate City to Birmingham.

CANAL.—The Resaca Canal & Manufacturing Co., of Resaca, Geo., has been organized, to build a canal from the Conasauga River to the Costanaula River.

MILWAUKEE, WIS.—Proposals for grading the Whitefish Bay Dumpty Railroad will be advertised for by Secretary Dupre (Mack's Block) as soon as the engineer's returns of the final survey are made.

RAILROAD.—The New York, Buffalo, and Philadelphia Railroad is sold to a syndicate of New Yorkers and Pennsylvanians, among whom is Hon. Carl Schurz, of New York City. Money has been obtained to equip it.

CHICAGO.—The opening of bids for dredging machines has been postponed by the South Park Commissioners to the second Wednesday in October.

KNOXVILLE, TENN.—McDonald, Shea & Co., of this city, were, on the 13th inst., awarded a contract for constructing a railroad from Oliver Springs to Clinton. The work is done for the East Tennessee Railroad Company.

SAN DIEGO, CAL.—The San Diego and Cuyamaca Railway has been incorporated, with a capital stock of \$1,000,000. Directors: R. W. Waterman, of San Bernardino and T. J. Daly, Q. Allison, M. G. Reffenberg, Milton Santee, I. M. Merrill, M. Klaber, all of San Diego. The line is to run to Julian.

FORT GIBSON, IND. T.—Cameron & McDonald are contractors for forty miles of the Valley Railroad from Wagner to the Illinois River.

POMONA, CAL.—Franchises have been granted to two of the proposed street railroads, the Orange Grove Street Railway Company and the Pomona Heights Railway Company. The former road has advertised for sealed proposals for construction.

BIDS OPENED.

MILWAUKEE.—Bids for constructing the proposed school building in the Thirteenth Ward were opened by the Board of Public Works September 13: Charles Kraatz, \$24,136; F. G. Horning, \$24,400; J. H. Lenecheck, \$23,900; A. H. Vogel, \$24,347; G. F. Stewie, \$23,825; H. P. Mueller, \$24,498; Oscar Knie, \$23,068; Henry Ferge, \$23,663; Frank Mirzerowski, \$22,000; John Fellenz, \$22,990; and William Klocksin, \$23,500. The contract was let to Frank Mirzerowski for \$22,000. W. E. Goodman secured the contract for doing the plumbing and gas-fitting in the building for \$834. The contract for putting in a steam-heating apparatus was let to Charles A. Barker, whose bid was \$3,095. The other bidders were: J. P. Rundle, \$1,097.50; Hazen Mooers, \$3,100; and M. Coogan, \$3,220.

PORT HURON, MICH.—The following bids for furnishing a pumping-engine (5,000,000 gallons capacity) for the water-works were received by W. H. Avery, Chief Engineer, September 15:

H. R. Worthington, New York, \$18,500.
Drane Steam-Pump Co., Holyoke, Mass., \$21,385.
George F. Blake, New York, \$23,920.
Knowles Steam-Pump Co., New York, \$16,000.
Holly Manufacturing Co., Lockport, N. Y., \$19,000.

DES MOINES, IOWA.—The following bids for iron floor-beams for Court Avenue bridge were received by Charles Bennett, City Engineer, September 15:
King Bridge Co., Cleveland, O., \$3,538, \$3,721.
Milwaukee Bridge and Iron-Works, Milwaukee, Wis., \$4,795.
Shiffer Bridge-Works, Pittsburg, Pa., \$4,790.
N. S. McDonnell, Des Moines, Iowa, \$3,280.
Kansas City Bridge Co., by J. B. Marsh, agent, No. 1, \$3,950; No. 2, \$4,075; No. 3, \$4,395.

GREENVILLE, MICH.—The following successful bids for constructing levees were received by William Starling C. E., September 12:
George Arnold & Co., Memphis Tenn., Longwood Levee, 2 3/4 c.; contents, 500,000 cubic yards.
C. Howard & Son, Pittsburg, Ind., 1 3/4 c.; contents, 90,000 cubic yards.
W. E. Ringo & Co., Mound Landing, Miss., 1 1/4 c.; contents, 100,000 cubic yards.

All bids on other works were rejected. Our correspondent adds that the work let on the high price of 2 3/4 c. is a very large levee, 2 1/2 miles long, and with an average fill of 15 feet, slopes of 3 to 1 back and 4 to 1 front; contents 500,000 cubic yards. The other prices are fairly low. Bids on enlargement work were regarded as too high, and were rejected. Most of this work has been let on private terms at better figures, to the extent of say 700,000 yards (prices, 19 to 22 cents) more.

THE SANITARY ENGINEER AND CONSTRUCTION RECORD.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 18. } PUBLISHED EVERY SATURDAY.

NEW YORK, OCTOBER 1, 1887.

LONDON, OCTOBER 15, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
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THE SANITARY ENGINEER AND CONSTRUCTION RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE SANITARY ENGINEER AND CONSTRUCTION RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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MANAGEMENT OF DRAW-BRIDGES.

It can scarcely have escaped the notice of any observing man, that draw-bridges are often unnecessarily made a nuisance. The bridge-tender is supreme; and by his leisurely ways, or the laziness which often saves a closing of the draw to the extreme discomfort and unnecessary detention of the land traffic, he shows his independence of all control.

The delays in Chicago from the draws crossing the river have for a long time been very serious. Some two months ago one of the Aldermen (Mr. Clark) conceived the idea of managing the draws by telephone from a central office. Those of the bridges are styled "gate" bridges, where vessels are allowed to accumulate for passage out and in. A favorable time by a lull in the traffic is watched for, and then vessels are passed both ways. After starting them they are passed along as rapidly as possible through other bridges, and one after another bridge is closed until the next batch accumulates.

A block is often stopped by knowing in advance the approach to a narrow part of the river of two wide vessels which could not pass, one being held back until the other passes.

The result of the system, which is by no means as yet fully perfected, is that the bridges are opened but one-fourth as often as before. The following table, taken from the Chicago Tribune, illustrates the present working between the hours of 8 A. M. and 9 P. M.:

Bridges.	No. Vessels.	No. Drawings.	Total minutes.	Average minutes per drawing.	Average minutes per hour.
Rush	85	39	174	4.44	13.03
Clark	83	32	132	4.01	10.02
Wells	83	32	158	4.90	12.01
Lake	74	32	158	4.90	11.09
Polk	67	32	158	4.90	12.01

The bridge-tenders are enthusiastic respecting the new system, since it gives them so much less work; and the tug captains like it because of the rapid movement when they once get started, the result being a real saving in time to them.

The wonder is that so simple an experiment for systematizing and controlling this important matter has not been thought of before.

CHOLERA.

THE steamship "Alesia," from Naples and Marseilles, with between five and six hundred immigrants, arrived in New York Harbor last week with Asiatic cholera on board. A few years ago this announcement would have almost created a panic; to-day, thanks to our increased knowledge of the disease, of the means by which it is spread, and of the best methods of dealing with a ship thus infected, every intelligent person knows that there is no ground for immediate alarm, because the presence of the disease has been detected in time and the buildings and appliances of the quarantine establishment of the port of New York are ample to meet the emergency.

How long it may be considered necessary to detain under observation at Hoffman's Island those passengers who continue apparently well it is difficult to say, since some of them have shown symptoms of the disease and have been removed to hospital, but it is highly probable that but few cases will occur among them,

and that in a short time it will be safe to allow them to continue their journey. Their baggage is probably more dangerous than their persons as a means of transmitting the disease, and while there is no doubt that it can be thoroughly disinfected, it may be a question whether it would not be best, in order to secure public confidence, to destroy it by fire and reimburse its cost to the owners.

But, while we have no fear of the results of the present importation of cholera and no doubt as to the thoroughness with which the germs of the disease will be destroyed in this particular case, it is evident that, until cholera has entirely and permanently disappeared, not only from the Mediterranean ports, but from Europe, there must be a certain amount of danger in every ship, and every immigrant with baggage, coming from these ports. That this danger is extremely small in each individual case is true, that it is little greater than that which is due to possible importation from other ports is also true, but the sum of all the risks is a very serious item. We have a very long frontier through which the disease may find its way, and only three or four ports with quarantine stations properly equipped to deal with it even if it is recognized.

It will not do, therefore, to simply rely on quarantine to prevent danger. We must recognize the warning and do what we can to put our cities and towns into such condition that even if the germs do find their way into the country, they shall die for want of favorable conditions for their multiplication and growth. How this is to be done is well known. Municipal cleanliness, the securing of water-supplies free from sewage contamination, and the doing away with the storage of excreta are the main points to be attended to. It is almost certain that we have yet six or eight months' time in which to look after these matters, but there is no time to lose.

PECULIAR METHODS IN THE DISTRIBUTION OF THE NEW CROTON AQUEDUCT REPORTS.

A CORRESPONDENT sends us the following evidence to justify our criticism of the methods adopted in the distribution of the Croton Aqueduct reports:

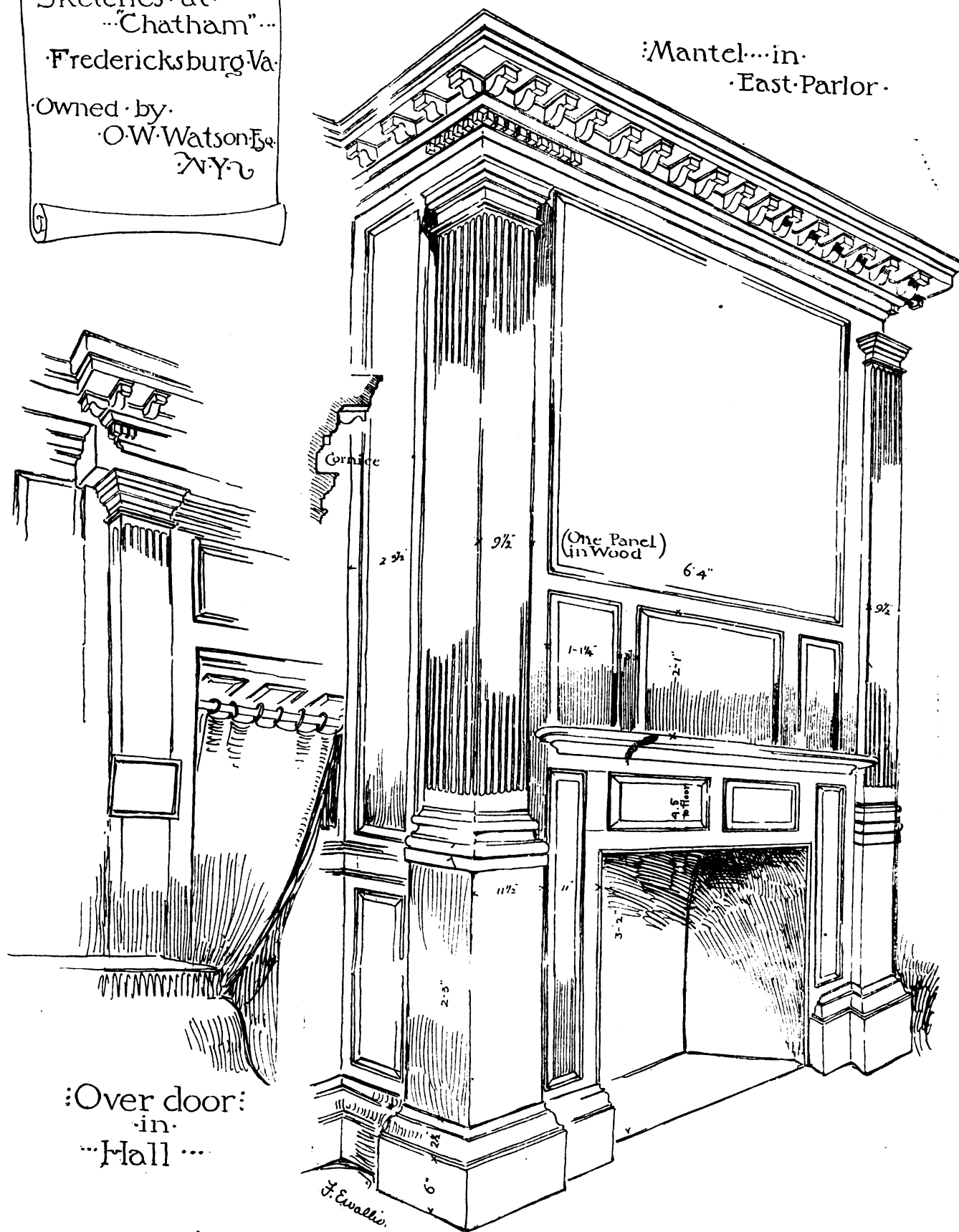
NEW YORK, September 27, 1887.

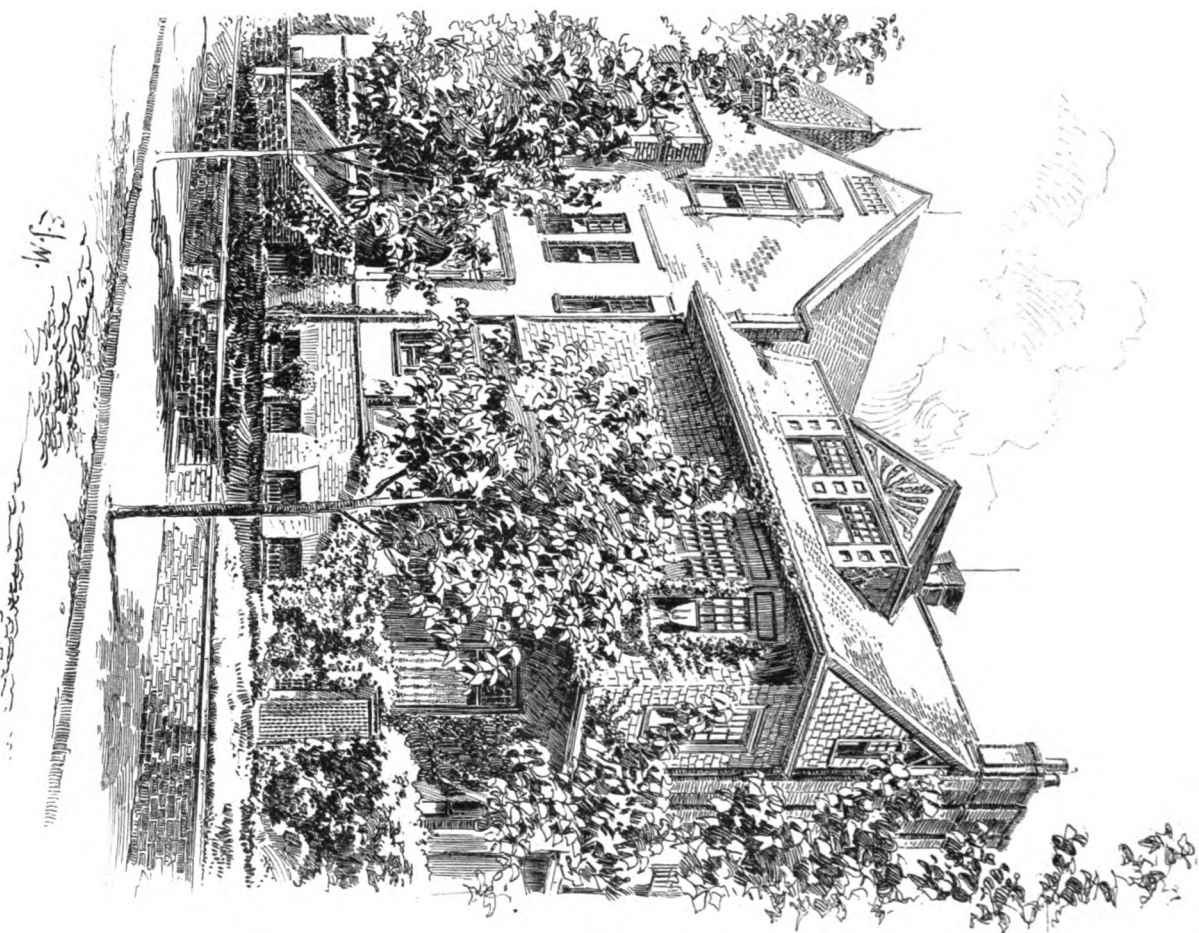
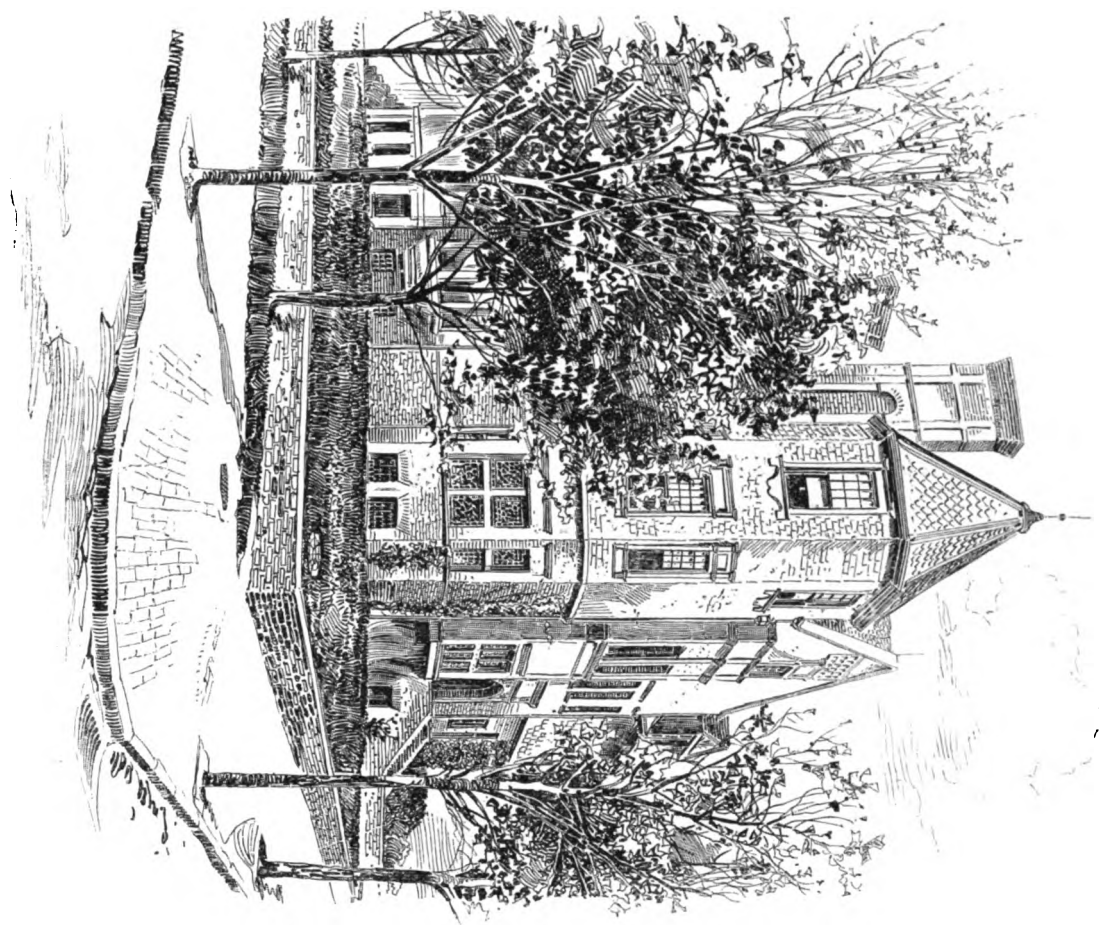
SIR: I have read with much satisfaction the editorial entitled, "Peculiar Methods in the Distribution of the New Croton Aqueduct Reports," which appears in THE SANITARY ENGINEER AND CONSTRUCTION RECORD of September 24, and I feel sure that the position taken will meet with the approval, not only of professional men, but also of the intelligent portion of the community.

In corroboration of what you have stated in the article in question, it may interest you to know that during a recent visit to Alexandria Bay, N. Y., where Judge Spencer, President of the Aqueduct Commission, has a summer cottage, I found one of the much-coveted reports in question lying on a table with newspapers in one of the prominent hotels.

Being interested, I was glad of an opportunity to examine the book, and on opening the cover the first thing to attract my attention was a slip of paper, on which was printed, "Compliments of James C. Spencer," while the name of the recipient, the hotel proprietor, was written upon one of the fly-leaves. Subsequently in conversation the gentleman who received the book informed me that Judge Spencer had sent copies of the report to some of his neighbors, and that while he had no interest in the work himself, he was unwilling to part with it because it was sent in a complimentary way. From this it would appear that at least one of the Aqueduct Commissioners prefers to use this valuable technical public document to advertise himself.

Sketches at
 "Chatham"
 Fredericksburg Va.
 Owned by
 O.W. Watson Esq.
 N.Y.





THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

A RESIDENCE IN M STREET, WASHINGTON, D. C.

M. EUGENE HEUARD, as reported in *Le Genie Civil*, resurrects, before *La Société Centrale des Architectes*, the idea of a slowly moving endless train of cars, which shall, by their tortuous winding through the grounds and buildings of the Exposition of 1889, banish all fatigue from the otherwise weary legs of the visitors. This train of flat cars, whose surface is to be even with the ground, is to run so slowly that children and aged people may step on or off whilst the cars are in motion. This train is not to go on forever, but at stated periods and places it will be brought to a standstill for fifteen seconds to allow of the passage of vehicles across its surface.

M. Heuard, discussing all previously known methods of sightseeing at expositions without fatigue, objects to the rolling chairs, because they are difficult of management in a crowd, which no one will dispute, and because they make every one who uses them look like a paralytic or an invalid.

The electric tramway he disposes of summarily because it is dangerous.

The elevated railway M. Heuard admits is an ingenious affair, but difficult of access and always frightens its passengers.

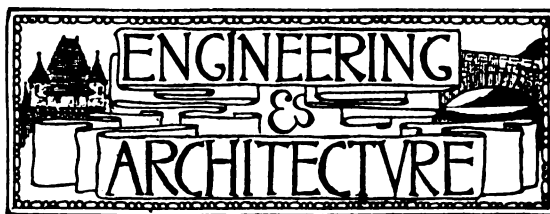
All methods of transportation present to the mind (?) of M. Heuard two difficulties: (1) They are expensive, as they will not carry people for nothing; and (2) that they all have a limit to their carrying capacity.

M. Heuard then asks, what the true solution of transporting great numbers of people is, and answers it satisfactorily to himself by a very long, minute description of his *chemin-qui-marche*, as he calls his endless train of flat cars.

THE AIR OF SEWERS.

"PROFESSOR CARNELLEY, D. Sc., and Mr. Haldane, of University College, Dundee, have been investigating the impurities of sewer-air, and find that the organic acid in the sewers examined was about twice and the organic matter three times that of the outside air, whereas the number of micro-organisms was less. As regards the quantity of these three impurities the air of the sewers was better than the air of naturally ventilated schools, while even mechanically ventilated schools were more polluted with organic matter. The sewer-air contained a much smaller number of micro-organisms than the air of any class of house, and the carbonic acid was rather greater than in the air of houses of four rooms and upwards, but less than in two and one-roomed houses. As regards organic matter, however, the sewer-air was only slightly better than the air of one-roomed houses, and much worse than that of other classes of houses. The amount of carbonic acid found by the observers shows that the sewers observed were better ventilated than those investigated by previous observers. They attribute the excess of carbonic acid over that of the outside air chiefly to oxidation of organic matter in the sewage and the air of the sewer. The excess of organic matter is probably chiefly gaseous, and derived from the sewage itself. The micro-organisms in sewer-air come entirely, or nearly so, from outside, and are not derived, or only so in relatively small numbers, from the sewer itself. This important conclusion is proved by the facts that the average number of micro-organisms in sewer-air was less than in the outside air, namely, as 9 to 16; that the number increased with the efficacy of the ventilation; that the average proportion of molds to bacteria in sewer-air was almost exactly the same as in outside air at the same time, whereas one would expect the proportion to be very different were the outside air not the source from which they were derived, seeing that such a difference has been proved to exist in the air of houses and schools. Another consideration is that the filthiness of a sewer seems to have no influence on the number of micro-organisms. Further experiments in the laboratory showed that the number of micro-organisms in sewer-air is diminished nearly a half in passing along a moist tube 5 feet long and $1\frac{1}{4}$ inches in diameter, at a rate of nearly 1 foot per second. There was, however, distinct evidence of the occasional dissemination of micro-organisms from the sewage itself; especially in splashing, owing to drains entering the sewers at points high up in the roofs. It is therefore important that drains should be arranged to avoid splashing. The authors' conclusions tend to make one more doubtful of the supposed evidence of the bad effects of ordinary sewer-air, when not vitiated by splashing."—*Engineering*.

AN experiment is being made in Brussels with a portable hospital composed of slabs of leather cardboard which can be easily attached, affording facilities for removal and reconstruction in a very short time. The hospital with which experiments is being made contains twelve beds which fold up within the structure, the inclusive cost of which is £120 (\$576). It is stated to be of American design.



MUD ARCHITECTURE IN PERSIA.

A CORRESPONDENT of *Indian Engineering* thus describes the method of constructing buildings with mud in Persia: "Nearly all the buildings in Persia are built of mud and sun-dried bricks ornamented with *gatch* or gypsum.

"The principal materials which enter into the composition of a mud building are straw, quicklime, gypsum or *gatch*, and stone pebbles. Any one desirous of having a residential house in or out of town, has only to give notice of his intention to the *Mehmarbashi* or the principal architect of the city or town—generally a Persian—who either repairs to the party himself or deposes his assistant or *Bannabashi* to ascertain the size, style, and description of the building required. This obtained, the *Mehmarbashi* or architect prepares a plan which he personally takes to the *sahib* and after explaining to him the general outside features and internal arrangement, and the cost probable, he leaves it to him to decide when, where, and how the house should be built. No building is started unless the day is auspicious—*rozikhair*—and when that day is determined upon, as also the size, style, etc., fixed by the future owner of the building, the *Mehmarbashi* is sent for and the *hukum* or order given.

"Thereupon the builder commences operations. Brick-making being the first thing he sends his *falehs* or assistants to proceed with that work. The bricks are made of clay previously prepared. This is done by first digging the ground and allowing the clay to remain exposed for two or three days in the sun. It is then saturated with water and exposed for two days longer, when it is subjected to the operation of *treading* or tempering. The clay is then molded into bricks $9\frac{1}{2} \times 2$ inches, and the surface is luted over with water mixed with chopped straw or *kah*, of which seven seers are used for every 1,000 bricks molded. This superficial plastering of straw is intended to prevent the newly-made bricks from cracking. A single molder can manufacture from 2,000 to 2,500 bricks per diem of six hours. The cost varies from eight to twelve annas per 1,000, and sometimes more when they are intended for the kiln.

"When the bricks (sun-dried) are ready, the *Mehmarbashi* marks the foundations according to the *rung* or plan, and the pits or trenches are then dug and the whole exposed for several days, generally one week, until the trenches and *debris* from the same are quite dry. The clay thus dug is of very tenacious character and is called *roost*, a kind of fire-clay. The foundation is laid in with this clay mixed with quicklime. It is well tamped and rammed and then allowed to stand over for a week. The thickness of walls is determined by the weight and height of the superstructure and is invariably spoken of as so many *fingers* breadth. The walls are built with unbaked bricks and clay and the arches with the same bricks and *gatch* or gypsum. A *bannabashi* or a mason seldom uses the rule or plumb-line when building a wall, his guide to straightness and verticality being the eye and the trowel.

"The small arches—of which there are many varieties—are never built with centrings as in this country. It is sufficient when the first ring is made; all others follow it endwise until the whole arch is completed in. It is made of a single brick on edge and kept in position in course of construction by means of the *gatch* and wedges of pebbles. The *gatch* dries as soon as applied on the edge of the bricks, which are pressed or placed in position before it dries or *dies*. The pebbles are used as wedges only in the extrados joints of arches where the joint is wider than in the soffits. The circularity of the arch is determined by means of a line or string from the centre of a bar placed along the springing of the arch, or rather span, or parallel to it, the said string being equal to the radius of the circle of which the arch is a part.

"Where arches exceed 10 feet in span and 30 or 40 feet in length, arched ribs are put in over centrings placed 10 feet apart and the arch-work of the spaces is filled in, as before, with bricks on edge—single—but without the help of centrings. Except in *tarbi* or extra strong arches where the bricks are used on their planes or flat—i. e., endwise—all other kinds of arches, such as the *gabri* or *Parisi*, which is never or seldom built without *shaloob* or centring; the *almastrash* or diamond-shaped, and the *ghace* or pointed—Gothic—are invariably built of single brick on edge.

"When the arches or domes are completed the spandrels or *sandooghas* are filled up with broken bricks carefully arranged. Over this is laid fine loose earth, which is rammed down to the required level preparatory to receiving the *kahgil* plaster, which is prepared in the following manner: The clay, to which is added chopped straw, is first made and well tempered by the feet. It is then allowed to stand for several days with water just covering the top of the clay, which is mixed in small tanks. When thus prepared it is laid over the loose earth which had been rammed level previously, and thus the roof is completed.

"The thickness of the *kahgil* plaster for the roof ranges between 3 and 4 inches. After the roof is completed the

parapet walls facing the streets and the neighboring buildings are raised 5 and 6 feet above the level of the roof, tapered, and similarly plastered with *kahgil*. The facade of the building is either plastered over with *kahgil* of finer quality colored with red or yellow ochre, and lined and paneled out in *gatch* or gypsum, or entirely plastered with the latter, and ornamented with moldings of the same material. The interior of the building—the rooms—are generally plastered with *kahgil* of the finest quality, called *sungil*, which is composed of fine clay, the husk of wheat, horse or cow dung, and the coloring matter. These are mixed in large vats and allowed to stand for several days—seven or eight days—when the clay is considered ready for use. It is then applied to the wall with a trowel, care being taken that it is uniformly laid. The projecting angles of walls and recesses are picked out in *gatch* and colored to suit the *kah*, or rather *sungil*, plaster.

"A single mason will lay in 2,000 bricks for a day's work. When the wall rises beyond the reach of assistants or bearers of bricks and clay, the bricks are not taken up in hod or basket, but are thrown up from hand to hand to men placed on scaffolds or stages until they reach the bricklayer. Leather gloves are worn by the throwers to save their hands from injury arising from the constant friction between the bricks and the palm of the hand.

"*Gatch* is only used in building of arches or moldings, and is never mixed up in larger quantities than a few seers at a time when employing it as a cementing material or for moldings. When in course of preparation for these works it is kept in constant motion to prevent it from *dying* or getting flat, and therefore useless. The *gatch* is much appreciated for its quick-setting and adhesive properties. It is the only and best cement used in arched masonry and moldings.

"The enclosure walls of the house are sometimes carried to great heights—30 to 40 feet—as a protection against thieves. They are built solid about two-thirds of the height, the remaining portion being built in *sandooghas* or chambers which run along the length of the wall—generally of enormous thickness at the base and gradually tapering to a point or edge.

"This is the *modus operandi* of building an ordinary dwelling-house, and though the same method is observed in the construction of more pretentious buildings, public or private, the difference is only in the choice of materials. There are huge buildings three and four stories high built of sun-dried bricks faced with burnt bricks, and the joints filled in with lime or fire-clay and glazed green or blue. Vaulted bazars are entirely built of sun-dried bricks decorated with figures and flowers in gypsum. The perfection to which clay has been carried in the constructive art is evidenced in the former and the present capital of Persia by the magnificent caravanserais known under the name of *Caravanserais Mukhlis*, the buildings in *Charbagh* or four gardens, the public buildings in *Maidanishah*, and last, but not the least, the *Halfdast* or the royal palaces, old and new."

INCREASED rapid transit for New York in the near future seems to be delayed in the same way as is the "Metropolitan" of Paris—namely, strangled in red tape, injunctions, and strife between advocates of the elevated and the underground systems. M. Boudenot, in *Le Genie Civil*, gives the following comparison of estimates, which will be of interest to the advocates of elevated structures as against underground transit, looking at the subject from a Parisian standpoint:

UNDERGROUND.	ELEVATED.
43 kilometres, slow, dangerous, disagreeable and not easily accessible.	63 kilometres of real railroad, rapid, agreeable, and easily accessible.
Total cost 387 millions francs, 9 millions per k. m. constructed.	Total cost 525 millions (but 20 k. m. more road), 9,300,000 francs per k. m. constructed.
Return on capital invested 3½ per cent., consequent loss on guarantee by the French treasury of 8,800,000 francs per year.	Return on capital invested 4 per cent., consequently loss of only 500,000 francs per year on the treasury guarantee.
Service rendered the public: Carrying capacity 50 millions of the 300 millions who now travel with the present conveyances.	Service rendered the public: Carrying capacity, 120 millions; besides the opening and rendering more healthy of new boulevards, streets, etc.

OUR ILLUSTRATIONS.

A RESIDENCE IN M STREET, WASHINGTON, D. C.

ARCHITECT UNKNOWN.

SKETCHES AT CHATHAM, FREDRICKSBURG, VA.

AN International Tramway (street railways) Congress has just been held in Vienna, papers being read on the establishment of a universal statistical bureau of tramways, fares, transfer-tickets, American street-tramways, and electric tramways.

ACCIDENT ON THE NEW CROTON AQUEDUCT.

COLLAPSE OF BULKHEAD.

A DISASTER occurred in the tunnel of the New Croton Aqueduct September 9, 1887, which was due to the collapse of the bulkhead in south heading of Shaft 17.

In order to intelligently understand the nature of this accident it will be necessary to give a brief description of the mode of working this heading, which is in soft material composed of sand and gravel. The system adopted for working in material of this character is called bar-timbering or English system, and the distinctive feature is the use of top-laying bars for holding the roof, while the whole lower portion is taken out, which leaves a clear open space for building the masonry. This system is supposed to have been first introduced in this country when the Allegheny Tunnel, on the Pennsylvania Railroad, was constructed in 1851.

In soft ground a drift is first driven clear through the length of timbers used, which are about twenty-one feet long; but the length of the drift is less, as a portion of the drawing-bars rest on the completed arch and short struts at opposite end, leaving the length of heading about sixteen feet.

The top of the drift is three or four feet above the extrados of the arch to be built, and nine feet wide. In starting the work an opening is made large enough to insert a square piece of timber 10x10 inches and nine feet long, shown at *p* in Fig. 3, which is supported by three posts of the same size, indicated at *m*, that vary in length from five to eight feet as circumstances may require.

A plan of this drift is shown in Fig. 4. On the top of the timbers *p*, poling-strips, or lagging, about six feet

The lower timbers are shorter than the crown-bars, and are not drawn forward, but left in place, and the pockets between them filled with masonry. As the depth of the excavation increases, the short posts supporting the crown-bars and caps are removed and longer ones substituted. The sills A, B, and C, indicated in Figs. 1 and 2, are inserted to support the permanent vertical posts, and form part of the bulkhead. The back of these timbers below A is lined with lagging to retain the sand in place, and thereby protect the subsequent construction of the masonry. A foundation for the brick-work is prepared by first laying timber longitudinally, and covering it with timber similar in character transversely. No attempt is made to place the poles regular in position on the arch, it not being necessary, as the section is always made larger than required to admit the masonry.

When the material has a tendency to run, the lagging and poling-strips are calked with hay, and, if necessary, where pockets are formed, they are lined with hay also. Where thought necessary for security, the timbering is carried down to the foundation, but Fig. 1 shows the timbering of this section to end three feet above this foundation. The full black line below lower sill C, Fig. 1, indicates position of sand in the sides of heading; the broken circular lines the relative position of masonry. The square timbers are 12 inches square, and round timbers 12 to 24 inches in diameter.

On the day of the accident the sills A, B, and C, and the struts resting on sill B, including the posts *a* to *g*, were in position. The brace E and short posts D and F, also a centre post back of brace E, were in place. The sills B and C were braced at their ends on each side of the heading by timbers abutting against the masonry shown in Fig. 2 at J and H; in fact, all of the timbering repre-

resulted in undermining it and the posts *a* to *g*, the weak point being shown in section at R Fig. 2.

The sand in this section was probably more shifting in character than any passed through in the section preceding it, and this condition did not develop until the moment of collapse. The open space three feet in height may have contributed to the weakness.

The force of the air was so great as to extinguish all the lights, which greatly increased the terror of the disaster. Fourteen men were at work in the heading and all except three escaped. The bodies of the men who were suffocated were found at the end of the invert of completed masonry, and had been caught by falling timbers.

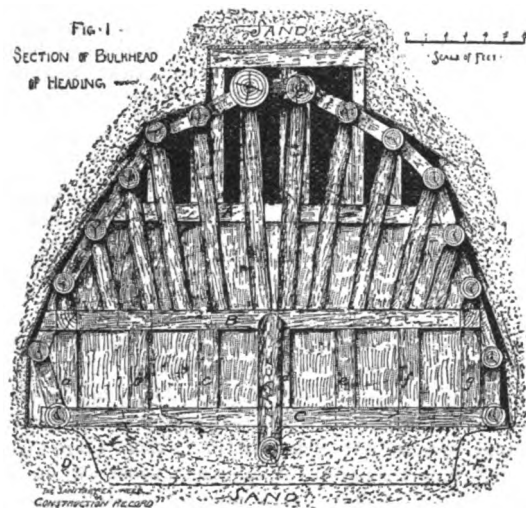
Everything was done which it was thought would contribute to safety; the preceding three sections having been worked in the same manner without any accident occurring.

ARTESIAN WELLS IN IOWA.

THE recent severe drought has turned the minds of farmers and others in Iowa to the subject of obtaining a supply of water from the earth. The *Iowa State Register* has given a number of articles calling attention to the success attained in the search both there and elsewhere, Des Moines and vicinity being the point more especially considered.

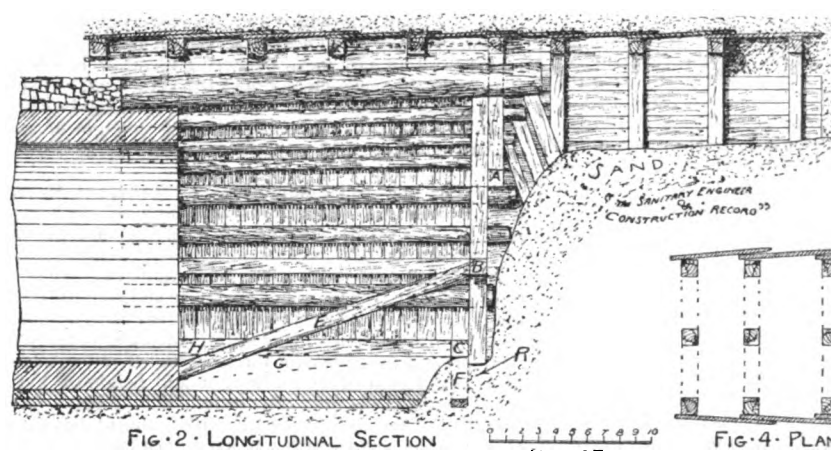
A recently driven well at the Capital City Hotel is 205 feet deep, and supplies 1,700 gallons per day, rising 9 feet above the surface. The cost of boring by hand was \$1 for the first 100 feet, and \$2 for the second 100. A further boring of 71 feet in granite added nothing to the supply. The cost of a 500-foot well is put at \$1,500.

It seems that one water-bearing stratum is found near the surface at about 30 feet depth, a second at 200 to 350 feet, and a third at a depth of about 1,400 feet. An in-



long, are driven inclined upwards as soon as the material in advance is loosened. The work is then progressed by carefully removing the sand from the top and inserting lagging on each side, as shown in Fig. 4 at *k*, to prevent the sand from running when this advance drift is being widened. As soon as practicable another drift-cap is inserted and supported by a centre post. When the sand outside of the lagging in this advance drift is sufficiently loosened, or pockets are formed, poling-strips are driven on each side parallel with the drift, the V-shaped lagging removed and the end posts inserted under the drift-cap. This process is repeated until the drift is advanced sufficient to draw in the crown-bars, which are placed from three to four feet apart from centres. These crown-bars are from eighteen inches to two feet in diameter. When drawn in position they are first supported at the forward end by short posts, the rear end resting on the completed arch. Poling-strips are driven transversely over these crown-bars, as shown in Fig. 3 at *k*. The forward end of the crown-bars are inclined upwards to permit them to be lowered free from the roof before advanced in the next drift.

The heading is then widened to permit two more crown-bars, one on each side, to be inserted, these bars being separated by braces indicated in Fig. 1. Four to six of these bars are called also drawing-bars, as they are drawn forward from section to section, unless they should become so firmly fixed in position that it would be cheaper to abandon them and use new timber. The heading is brought to the full width and depth required by inserting alternate timbers on each side until the necessary depth and width required is obtained, the transverse poling-strips being continued to the bottom.



sented in Fig. 1 was in place. The side braces holding sills B and C were heavy oak timbers. The three preceding sections had been timbered in precisely the same manner without any accident occurring. The work was examined in the morning by Alfred Craven, the Division Engineer, and also by Gaylard Thompson, the assistant engineer in charge, and they considered this bulkhead to be as well secured for safety as any that preceded it. In the afternoon Mr. Thompson advised Mr. Breuchaud, the Superintendent, to put a brace at centre of lower sill, to rest against the invert at J, as indicated by the dotted line at G in Fig. 2, but this suggestion was made as an additional precaution only. Before the accident occurred, the order for this brace had been given by the superintendent, and preparations made to insert it, but the collapse came before the brace could be put in position.

As an examination had been made previous to the accident, it was known that no voids were left over the poling-strips to permit the sand to run, as the sills were resting on the poling-bars indicated by dotted line over large bar in Fig. 2.

When the accident came it was without a moment's warning; the whole timbered section appeared to fall down at once, and the entire heading filled with sand immediately, except a small space at the crown. The crown-bars did not break until they struck the bottom. The timbers on the east side appear to have fallen all the way down, but the timbers on the west side were partially held up. The supporting struts on the east side fell with the bars, but the struts on opposite side remained up. As the posts *a*, *b*, *c*, *d*, *e*, *f*, and *g* rested on the sand, the removal of this material in front of it within two feet of lower sill C is supposed to have started the sand in motion, which

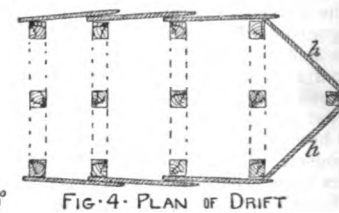
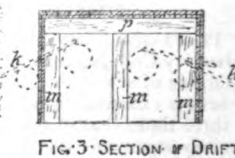
interesting fact has been noticed that along a certain strip of territory lying in a north-west and south-east direction, water is sure to be found, while failures have occurred at other points. The usual experience has been noted, also, that a heavy draught on the water at one point affects the supply at other points in the vicinity.

At Belle Plaine several artesian wells were developed until the great geyser was struck. Before that the wells threw the water 80 or 100 feet high; since it has been confined they have begun to spout again.

Commenting on the present scarcity of water, the *Register* says:

"The creeks, brooks, rivers, and springs, which used to be so abundant and so unfailing, have not only dried up under the scant rainfall, but the common supply of water by wells has also failed to a serious degree. Farmers who never wanted for water in thirty years, either in creeks or wells before, have suffered from want of it in the past two years. The natural process of streams lessening in volume as a country grows older, added to the dry weather we have had for these two years, has dried up many surface and under-surface streams. As one farmer remarked yesterday: 'Digging for wells no longer avails. The first vein of water which could always be tapped in Iowa from twenty to thirty feet in years past, has gone dry, and now even the second vein, forty to sixty feet below the surface, very often fails. If the dry weather continues another year, we shall have to depend on artesian wells.'

"In Des Moines and its suburbs are perhaps a dozen artesian wells—the most of them 200 feet deep, none over 350. But other holes or shafts in or near the city sunk 600 or 800 feet deep have failed to develop artesian wells. In boring for natural-gas, within six miles of Des Moines, in the direction too of the artesian-well fields in Story and Hamilton Counties, some holes have been sunk as deep as 1,700 feet without finding artesian wells. Of the numer-



ous wells in these explorations, only one six miles from Des Moines and 800 feet deep has developed artesian water, and it delivers the stream forty feet high, and yields five barrels of water a minute."

It is stated that a flowing well exists in France which was bored in 1126. In Iroquois County, Ill., there are over 200 wells within a radius of 20 miles of which the average depth does not exceed 70 feet.

Shale, sandstone, limestone, and chalk have all yielded copious supplies in many localities.

Professor Frank Laverett gives a discussion of the question of the requisite conditions for a true artesian well as follows:

1. A pervious water-bearing stratum.
2. An impervious stratum below.
3. A second impervious stratum above the water-bearing stratum.
4. These must be inclined.
5. There must be no adequate outlet for the water at a lower level than the water.
6. A sufficient collecting area or reservoir with the porous stratum.
7. The collecting area must have sufficient elevation to act as a fountain-head.
8. There must be a continuity of the permeable bed.
9. There must be no flaw or breach in either of the confining beds.

The previous water-bearing stratum is usually sand or gravel or sandy clays.

The impervious strata are usually of some compact clay or agglutinated pebbles, or of hard rocks. The necessary inclination of the strata is given by Professor Chamberlain in Vol. I. of Geology of Wisconsin as at least one foot per mile. This is quite an important condition in rainless regions, where the water-supply may flow in subterranean beds for hundreds of miles, which makes it necessary that the collecting district shall be elevated so many hundred feet above the permeable bed where it is tapped. The fifth condition will be better understood perhaps by illustrating with an inclined tube representing the permeable stratum, the walls the confining layers. Suppose water is flowing through the tube so rapidly that it is full, and that near its lower end an opening be made on the top of the tube. If the water does not have an adequate outlet at the lower end of the tube it will be forced out through this opening, and illustrate the jet of water from an artesian well, but if the water flows freely out of the lower end of the tube it will not be forced out through this opening in the top. The sixth condition was overlooked in boring for a well at Colorado Springs. This city is so near the mountains that the collecting area, which is only a few square miles and in a dry region, is utterly inadequate to saturate the pervious beds which underlie the city, and are otherwise favorably situated for yielding artesian wells. The seventh condition, I think, finds illustration in the artesian well districts of Iowa.

The eighth and ninth conditions have often been neglected in a study of well districts, and have a claim to close attention before the study of a district is complete. There has been loss in two ways, which are singularly in contrast to each other. Sometimes a region but partially studied, and faults or breaks in the strata neglected, has disappointed the confident persons who rely on strata being undisturbed and continuous throughout districts of wide extent. They made a boring with their theoretical sections of strata, perhaps drawn on a map hanging near by, and find that a fault or break or change in the character of the strata below has entirely spoiled their calculations.

A second way in which wrong notions obtain prevalence is due to an imperfect or incomplete study of a region in which certain places are found in which artesian wells cannot be obtained, and it is at once concluded that the whole region is not favorably situated for obtaining artesian wells. This idea prevails perhaps until some one unintentionally strikes a favorable place and obtains a flowing well. There is likely then to follow a great expenditure of money in prospecting for wells anywhere and everywhere over the region regardless of what was taught by the early experiments and failures.

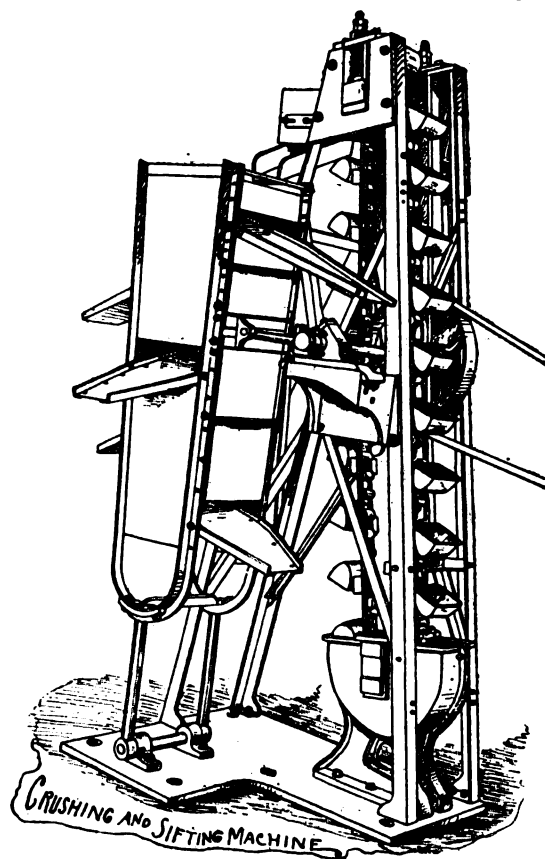
It may be by this time be in the mind of the reader to say, "What can the geologist tell us about artesian wells if there are so many conditions affecting their being obtained?"

I will candidly admit that the subject of the favorable places for obtaining artesian wells is one that requires more than theoretical study. As complex and ever-changing as the strata are, there is a necessity for actual sections obtained from borings, and these borings should be sufficiently abundant to give confidence in what they reveal concerning the character of strata, source of water-supply, height to which water will rise, etc. The geologist requires all this, and more too, aside from his theoretical knowledge of wells, before he can be considered as authority on this subject. He then has a work which no one else does—viz.: To collect facts and arrange them in the form of a report which will show the present status of knowledge of the region, so far as this knowledge relates to artesian wells.

UTILIZATION OF WASTE PRODUCTS.

WE give an engraving of new machinery recently introduced by the Corporation of Burnley, for converting old setts, broken flags, masons' scalplings, boulders, rough gravel, old bricks, quarry refuse, etc., into fragments of

any desired size for concreting purposes, or into sand for mixing with the same; shingle or racking of a cubical form for inserting between the joints of paving to be afterwards grouted with asphalt or cement, and materials for tar-paving, at a cost of 3d. per ton. Any apparatus or arrangement having for its object an improved method of preparing and producing materials for engineering works—especially if capable of utilizing waste substances such as are mentioned above, and at a nominal cost—must be interesting to municipal engineers and surveyors. There have been for some years past crushing-machines, mostly with revolving screens, made in Leeds, Manchester, and elsewhere; but as we have not had an opportunity of examining them we are not able to speak as to their action. We understand that this description of machine was formerly used in the town of Burnley, but it was found that the circular revolving arrangement did not sufficiently separate the different sizes, an objection engineers frequently raise against this form of screening, especially in reference to broken stone for concreting purposes, and shingle or racking for paving works. On account of the broken stone not being perfectly clean and free from small particles of dust, etc., a greater portion of smaller material than is specified is contained in the aggregate, which consequently adulterates the cement, and greatly reduces the strength of the concrete; and the shingle or racking not being per-



fectly clean and free from finer particles and dusty substances, the asphaltic mixture for grouting will not adhere to it, and the paving is not rendered impervious.

With regard to the machine illustrated above, and which has been invented by Mr. John E. Stafford, A.M.I.C.E., the Borough Engineer of Burnley, the materials to be dealt with are put into the reducing-machine (not shown on engraving), which can be regulated to make different sizes. They are then conveyed by an elevator to the screening apparatus, and separated into as many sizes as are required at one operation. All the material too large for the size required is returned to the reducing-machine to be broken again. In sifting the contents of dust-bins, etc., which is at present done by females and youths in some of the vestry-yards in London, the boot or receiver at the bottom of the elevator is dispensed with. The elevator is extended so as to reach to the bottom of a sloping pit sunk below the surface of the ground, and into which the dust-cart empties its contents. The dust, etc., fall by gravitation into the elevator buckets, and are conveyed to the top of the screen. Rags, pieces of paper, etc., are automatically intercepted and collected before entering the screen; old tins, bottles, hard and soft core, and fine dust being separated as required. The latter is prevented from escaping into the atmosphere, as is the case when being sifted by hand. It should be stated that an important feature of this machine is its having a combined radial, oscillatory, and positive shaking action, being precisely similar in

motion to riddling by hand. The material is turned out as cleaned and distinctly separate as if it had been washed.

Among some of the advantages of this apparatus, six different kinds of material, varying in size from the finest dust to stone for concreting purposes, can be produced at one operation, and automatically discharged direct into carts or wagons at a saving of one-half the cost of the arrangement generally in use. All the materials are perfectly clean, separate and distinct from each other, and ready for immediate use. In producing materials for concreting purposes, the machinery can be regulated to produce the specified proportion of sand required. River gravel and waste material, such as old bricks, broken flags, boulder, etc., can be reduced to angular fragments, and used for spreading on wood and granite pavements in wet and very hot weather. The construction of the machine is of a very simple and ingenious description, and can be erected on the ground-level, thereby saving cost of expensive elevated foundation, and curtailing the expense of working. Considerably more material can now be treated than could formerly be dealt with by the old breaking-machine and circular revolving screen arrangement, and the products are more uniformly cubical in shape, and much less wear and tear of machinery and waste of material is experienced.

We are informed that since the introduction of the system at Burnley a saving of £200 per year in working expenses alone has been effected in the production of shingle or racking for paving purposes. The various materials are required in enormous quantities in towns, especially where impervious paving is put down, and the average cost per ton in the majority of towns using at least 10,000 tons per annum is as follows: broken stone, 2 inches, 3s. 9d. per ton; shingle or racking, 6s. 6d. per ton; and fine sand, 4s. per ton—an excess of 75 per cent. compared with the cost of the materials at Burnley.

PAVEMENTS AND STREET RAILROADS.

No. XVI.

(Continued from page 461.)

WOOD PAVEMENT IN THE METROPOLIS.*

THE DISCUSSION.

MR. G. H. STAYTON said he had been told that his paper did not deal with the obnoxious smells sometimes experienced in connection with wood pavement. He thought, however, that he had dealt with the subject fully under the head of management; he had certainly intended to do so by drawing attention to the absolute necessity for a plentiful supply of water for the purposes of cleansing. Of some samples of wood pavement which he exhibited, one block had been taken up from Oxford Street a month or six weeks ago, and it showed that wood pavement could be worn down to the thickness of a mere crust, and still retain a fair surface. It was originally about six inches in depth, and was laid in 1878. The wear was simply owing to the traffic upon it.

Sir Joseph Bazalgette, C. B., president, asked if the author could give any further opinion on the subject of traction and foothold with wood pavement as compared with other kinds of pavement.

Mr. Stayton said he could give no further opinion on the subject. It had been exhaustively treated a few years ago by Mr. W. Haywood, the city engineer; he had not, therefore, thought it necessary to deal with it again. The average thickness of the pavement at present in Oxford Street was about 3.30 inches; but at certain parts it was not thicker than the block to which he had drawn attention (1 3/4 inch), which was a fair specimen of the pavement at those parts where the traffic was concentrated.

Mr. W. Lawford remembered when, in 1841, a part of Whitehall and a part of St. Giles were laid with Rankin's patent wood pavement. It was down only six or eight months when it failed, owing, as he believed, to insufficient drainage and a bad foundation; besides which the cost came to £2 10s. or £3 per square yard. The success of the present wood pavements was no doubt largely owing to the good foundations on which they were laid. He remembered seeing the pavement put down between the Chapel Royal, Whitehall, and the Horse Guards. There was no concrete, but only a wood framing as a sub-structure. A full description of it, with illustrations, would be found in the *Civil Engineers' and Architects' Journal*, for September, 1841.† From the same publication he found that in 1838 many streets in Philadelphia were paved with wood, and he believed that the pavement remained to the present day, but he did not know the results.

Mr. W. Weaver considered that some apology was due from him as Surveyor of the parish of Kensington, where by far the largest area of wood pavement had been laid, for not having presented a paper on the subject to the Institution; but as the terms under which he held his appointment involved the devotion of his whole time to

* Henry Stayton, Assoc. M. Inst. C. E., and president of the Proceedings.

the duties of his office, he had come to the conclusion that he could not abstract from those duties the time necessary for the preparation of such a paper. He agreed with the author in the three propositions at the end of his paper, especially the third, that notwithstanding many former instances of failure, the modern system had achieved a fair amount of success, and that there was no apparent reason why its use should not be extended. So far from there being no apparent reason why its use should not be extended, he thought there was a good apparent reason why its use should be very much extended in consequence of an injunction that had lately been granted against his board with reference to the use of steam-rollers. If that decision was not upset (the parish authorities were about to appeal against it) he did not think the public would like to revert to the state of things existing twenty years ago, when the traffic had to plough its way through the newly-laid macadam, and in such case wood pavement was likely to extend very much. There were some details on which he could not quite agree with the author, one of which was the statement that wood pavement was laid down better and cheaper in Chelsea than in any other part of London. In Kensington seven different kinds of pavement had been tried—he believed every known kind except Carey's keyed-joint—and the result of his experience of those systems had led him to believe that the most economical wood pavement that could be laid was the plain deal, if it was to be laid under competitive tenders where the wood had to be inspected to see that it was of a proper description; but if the work was not tendered for, if a good price was given for a good article, and it was wished to have the work done expeditiously, he preferred the system of the Improved Wood Paving Company with pickled blocks and asphalt joint. The work was got through much more rapidly in that way, and from the results in Kensington, he was sure that the system would last as long, if not longer, than the plain system; the cost, however, was about 1s. 6d. per square yard more. The assumed superior merits of the wood pavement in Chelsea appeared to be due, according to the author, to the work having been executed by his own staff and the substitution of studs for asphalt or laths. But he could not see the advantage of the parish doing the work with their own staff. If they invited tenders for the supply of so many tons of Portland cement, so many cubic yards of Thames ballast, and for breaking up the surface, they had merely a series of competitive tenders for the work in detail, whereas in the other case they had one tender for the complete work; and he thought that the one profit in the latter case was less than the various profits in the other. He might mention a practical illustration which had come under his own notice in the Fulham Road. It was the last extensive piece of work that the author had done, and at the same time Mr. Weaver was paving a portion of the same road under his charge extending from the Brompton Oratory to Thistle Grove. In his own case, the work was done by Messrs. Nowell and Robson under contract, at 9s. 5d. per yard, whereas in the author's case it was 10s. 3d., or 10d. a square yard more, and the time of execution was about forty per cent. longer. It would be apparent to every one practically acquainted with the subject that it was necessary to consider not only the question of cheapness in first cost, but the interests of those who were to find the money for the execution of the pavement—namely, the ratepayers, some of whom were abutting frontagers; and it was a matter of considerable moment to a shopkeeper on a line of thoroughfare to have his receipts diminished £5 or £20 a week in consequence of the road being up. Time, therefore, was of great importance. Again there was a great disadvantage in having to pick up the laborers almost as they came; it might take several weeks to get them into working condition; but if the order were given to an established firm they could at once send a number of men of experience in their several departments, so that they would get half-way through their work before the others had started. The question as to when it became economical to substitute wood-paving for macadamized roads was an important point for a board to consider when about to launch a large wood-paving loan. His figures were not quite the same as the author's, but they came to very much the same in the result. He was not able to separate the scavenging from the maintenance; but he had always advised his board that if a macadamized road cost 1s. 6d. per square yard per annum for maintenance, it was cheaper to put down a wood pavement, and that was a very similar conclusion to the one at which the author had arrived. With regard to the question of studs, he had tried various kinds, single-pointed and double-pointed, but his experience was that they did not produce such regular jointing as asphalt or lath-joints, the lath being left in. If the lath was withdrawn, the brooms passing over the surface sweeping in the liquid grout disturbed the regularity of the surface. Studs were generally driven in by boys, who were not models of carefulness, hence some were driven in very hard (perhaps after the men had had their dinner), while in other cases, when the men were tired, a good deal of the stud projected. He would leave the practical point as to superiority to be decided by members who could examine and contrast the two pieces of pavement in the Fulham Road to which he had alluded; that east of Thistle Grove, executed by Kensington, and the other portion west, carried out by Chelsea.

Mr. L. H. Isaacs regretted that he could not agree with either of the three proposals which the author had asked the institution to indorse. The paper appeared to be written with optimistic views, the author having charge of

a suburban or semi-suburban district, and apparently not being aware of what actual London traffic was. The instances of wear and tear which he had cited were confined to King's Road and Sloane Street. Mr. Isaacs desired to set against them the experience he had obtained in a central portion of London over which London traffic, in the strict sense of the term, actually passed. The statement that wood pavement was calculated to last seven or eight years was, he thought, misleading. He was ready to indorse all that had been said as to the comfort and convenience of wood pavement, but the question of cost ought also to be considered. The author's first proposition stated that where the ascertained cost of maintaining and cleansing a macadamized carriageway exceeded 2s. 2d. per square yard per annum, or where the traffic was so considerable that a quieter and cleaner pavement was deemed essential, the substitution of wood was desirable. He entirely agreed with the second part of the proposition, but the first was wrong. The author had admitted that the statistics of his own office showed that the cleansing amounted to 11d. per square yard per annum, leaving for maintenance 1s. 3d. per square yard per annum. If he had gone to London proper, he would have found that the cost of mere maintenance was from 6d. to 1s. In his own district the cost in some streets was 6d., in others 9d., and in the majority 1s. Mr. Weaver had stated that about 1s. 6d. was the proper sum due to maintenance. Which was right? Or would engineers be justified in rejecting the advice of both, and taking instead the evidence of a man like Mr. Haywood, the City Engineer, who had charge of streets over which true London traffic passed? With regard to the economy of wood pavement, the author had clearly failed to prove his proposition. It was certainly convenient, indeed luxurious, and where the ratepayers were willing to pay for the luxury, there was no reason why they should not have it. When a rich banker drew a check for the rates of his premises, rated perhaps at £10,000, it was of little consequence whether the amount of the check was £1,500 or £2,000. In like manner it was a matter of indifference to a wealthy inhabitant of Prince's Gate whether in drawing a check for the rates of his house the amount was £160 or £200. Such persons would rather draw for a larger amount and have the comfort of a noiseless pavement, than draw for the smaller amount and revert to the old state of things. The author's third proposition "that notwithstanding many former instances of failure the modern system has achieved a fair amount of success, and that there is no apparent reason why its use should not be extended" had been drawn with great caution. There had been no doubt "a fair amount" of success, and enormous improvements had been made in the wooden pavements of the present day, as compared with those put down twenty-eight years ago; but, after all, the question was very largely one of cost. He would invite the members to consider Chancery Lane, Southampton Buildings, High Holborn, Lamb's Conduit Street, Hatton Garden, and Great Ormond Street, which it would be admitted were fair representatives of streets with ordinary London traffic. They were all under the jurisdiction of the Holborn District Board of Works. Chancery Lane was first laid with wood in the Michaelmas quarter of 1876 by the Improved Wood Pavement Co., which he thought was one of the best wood-paving companies in London. The area was 1,960 square yards, and the first cost was £1,557 10s., or about 15s. per square yard. The complaints against it were numerous and grave. It was laid on the principle adopted by the company of transverse boards, with concrete as a foundation. The noise of the traffic passing over the granite pavement which previously existed was so great that the dwellers in Stone Buildings and Chancery Lane petitioned the board to lay down wood pavement, and even offered to contribute to the cost; but after it had been down a few years they complained of the shaking of the windows and the general unpleasantness, and asked that it might be taken up again. The company, on being communicated with, stated that they had come to the conclusion that the system adopted was a mistake, and that they were prepared to alter it. To their credit it should be stated that they took up the whole of the pavement and relaid it at their own cost upon their modern improved system, with entirely new blocks and new materials. That was in 1881, and no complaints as to rumbling and vibration had been made since that time. If the pavement lasted till 1886 he should think it would have done its duty, and he would have no cause of complaint. The wooden pavement of Southampton Buildings, where the traffic was much lighter than in Chancery Lane, was laid down in the Christmas quarter of 1876. It contained 1,063 yards superficial, and the cost was £824, or 15s. per square yard. It was largely relaid in the year 1882. The first pavement that he took in hand when he was appointed Surveyor of the Holborn District was the wood pavement in High Holborn, which he removed, and for which he substituted granite pavement in 1857. In the Christmas quarter of 1877 a wooden pavement was laid down in High Holborn. The portion in the Holborn District contained 3,842 yards superficial, and its cost was £3,030 1s., which again was about 15s. per square yard. That pavement entirely failed to carry out the views, not only of himself and of the board, but of the company which supplied it, although they were paid the highest price for laying it down, and for subsequent maintenance. The pavement was continued through New Oxford Street, as far as Tottenham Court Road, and it was considered at the time as fine a sample of wood pavement as had been laid in London proper.

(TO BE CONTINUED.)

ANNUAL REPORT OF THE SEWER COMMISSIONERS OF NEW LONDON, CONN.

THIS Commission was organized under State laws in April, 1886. The engineer of the Commission is Mr. Walter H. Richards, with Mr. R. Hering as Consulting Engineer.

The contract for the plan of intercepting-sewers was let in July of that year to Mr. M. S. Austin, and the work completed in February last, at a cost of about \$32,000, varying from 40 cents to \$3.25 per foot.

After a careful examination of all the property, and of the rules adopted in other cities, the engineer recommended the adoption of a plan of assessment based partly upon frontage and partly on area of lot assessed—six-tenths to area and four-tenths to frontage, with the following modifications: the area to be calculated to a line parallel with, and not more than 100 feet distant from, the street frontage. Frontage of corner lots may be exempted for a length of not over 100 feet, frontage to be assessed on the longer side, where both sides are less than 100 feet long each. Irregular lots dealt with specially.

The rates thus worked out were 50 cents per foot front, and 7 mills per square foot of area.

Three plates are given of details of wooden tidal-sewer, tide-gates, junction, etc. A description of this interesting sewer-work with illustrations was given in this journal, issue of March 19, 1887, page 401. Rules and regulations for plumbing, etc., are given in the appendix of the report; also, a full description of the work in progress.

THE SAND-BAR AT THE RAILWAY BRIDGE ACROSS THE RED RIVER AT SHREVEPORT, LOUISIANA.

THE report transmitted to Congress in March last is interesting as showing the difficulties to be contended with in crossing streams of this character. Contrary to what is usually expected, the general tendency for five years, as shown by the soundings on the axis of the bridge, was to fill over the whole line, so that Captain Willard reported in February last that five feet was the lowest stage at which the draw-opening was navigable. As the river is navigable for 300 miles above and 500 miles below the bridge, the matter is one of great importance, especially as the Government has spent considerable sums upon the navigation of the Upper Red River.

An examination of the United States statutes failed to reveal any law of Congress authorizing the construction of the bridge, and it was reported upon as subject to removal by process of law. Captain Bergland, of the Engineer Corps, suggested two plans for removing the bar: (1) By mooring barges above the bridge with movable plank sheeting extending to the bottom, so as to contract the current and scour away the bar; (2) to build low pile and plank jetties.

The act of Congress of July 5, 1884, gives power to the Secretary of War, and makes it his duty if he has reason or thinks it necessary,

"To require the company or persons owning, controlling, or operating said bridge to cause such aids to the passage of said draw-opening or of said raft-span, or of both said draw-opening and raft-span to be constructed, placed, and maintained, at their own cost and expense, in the form of booms, dikes, piers, or other suitable and proper structures for the guiding of said rafts, steamboats, and other water craft safely through said opening or span, or both said opening or span, as shall be specified in his order in that behalf," etc.

Under this law notice has been served upon the authorities of the railroad to take proper steps to remove the obstruction.

IRON-WORKERS IN EUROPE.

J. H. FLAGLER, the General Manager of the National Tube Works, was given a reception at McKeesport, Pa., recently, by the employees of the company, on the occasion of his return from Europe. Mr. Flagler made a speech to the employees on the result of his observations while abroad, in which among other things he said:

"I have seen people working for ten, twelve, and fifteen cents a day, and in some factories seldom obtaining above twenty cents a day. I have seen the same class of labor earning \$1.25 to \$1.30 in this country getting but thirty and forty cents. The same disproportion exists in the workers of metals in many places; and yet there are people in this country who call themselves friends of the workman and yet advocate a policy that would bring down wages to this same level. They don't seem to recognize that the conditions of this country are vastly different from those in Europe, climatic and otherwise. The same food would not sustain the wage-earner here, and other conditions as well make it necessary that higher and better rates shall ever rule in this country; consequently any policy advocated detrimental to your interests means a blow at the working class and the prosperity of the country."



ENGLISH PLUMBING PRACTICE.

BY A JOURNEYMAN PLUMBER.

No. LXIX.

(Continued from page 436.)

HOT-WATER CIRCULATION (CONTINUED).

SOMETIMES, as an economy, the return circulation-pipe has been of a smaller size than the flow-pipe. For instance, a $1\frac{1}{4}$ -inch flow-pipe has been fixed from the cylinder to the furthest point away and an inch pipe carried back to the cylinder. This is not a good plan, as reducing the size of the pipe causes, by the extra friction of the smaller pipe, a sluggish circulation of the hot water. In addition to the extra friction of the water in the smaller pipe there is also, proportionately, a larger radiating surface and consequent loss of heat, so that for these reasons it is advisable to have the circulating-pipes of the same bore throughout. Another view of a small return-pipe may be mentioned—viz., the smaller the pipe the larger proportionately is the radiating surface, so that the temperature of the return-water is much more reduced, and theoretically this ought to cause the water to circulate more freely.

In some cases the hot-water cylinders are fixed horizontal instead of vertical.

Figure 1 is a sketch diagram of a cylinder fixed horizontal and the circulation-pipes, as recently fixed under

also for heating corridors or rooms by radiators is a good one, as it is almost impossible to keep one constant heat.

In some instances a hot closet has been fixed in a kitchen, for warming plates and dishes, and connected with the boiler circulation-pipes. For want of the proper knowledge some of these have been found to be failures. The writer had to inspect one that had been fixed but a few months, but no matter how hot the water was in the boiler the closet was always quite cold.

Figure 2 shows the arrangement. The man who fixed it said he would give it up and own he was beaten, but when asked if water or air was in the coil Z, he at once saw where he had made a mistake. He then made the necessary alterations so as to allow the pent-up air to escape from the highest end of the horizontal coil. Acting on advice, he also connected both ends of the horizontal coil to the flow-pipe from the boiler and put a small perforated disk of copper at Y so that the water did not circulate past and miss the T-junction. This air-binding of pipes is of frequent occurrence and in a great variety of ways. In a row of six mansions a stupid blunder was committed in each house. The storage capacity for cold water was too little, with the result that the cisterns would frequently get emptied. Every time the cisterns were emptied and filled again, it was found impossible to draw water at the hot-water taps. The reader is referred to Fig. 3, which shows what was found. The cold-water supply to the boiler was connected to the bottom of the cistern, and, about six feet away, the pipe was lifted about two inches, so as to fix it with a pipe-hook to the wooden bearer on which the cistern was placed. On taking out the hook in each house, and lowering the pipe, air came bubbling back into the cistern, after which the water ran freely into the boiler, and could be drawn at the various taps. It may be further explained that the bottom end of

wide apart. No matter how many sets of circulating-pipes are fixed, it is always necessary to have a vent-pipe from the highest end of each to allow the air to escape. In some cases a draw-off pipe has been fixed near the highest end, on opening which any air could escape, but this is not by any means a good system to adopt. When air-pipes are fixed, it is scarcely necessary to add they must be carried to a level above the cold-water supply-cistern.

A reason was given in an earlier paper for connecting the return-pipe to the cylinder, instead of branching it into the boiler or the cold-water service-pipe to the boiler. To prevent water from being drawn from the return or cold, instead of the flow or hot-water pipe, some makers will fix a small flap-valve, inside the circulating-pipes, that opens in the direction of the flow of water when circulating, but closes should the circulation by any means become reversed, or to prevent back-water being drawn when a tap is opened for drawing hot water.

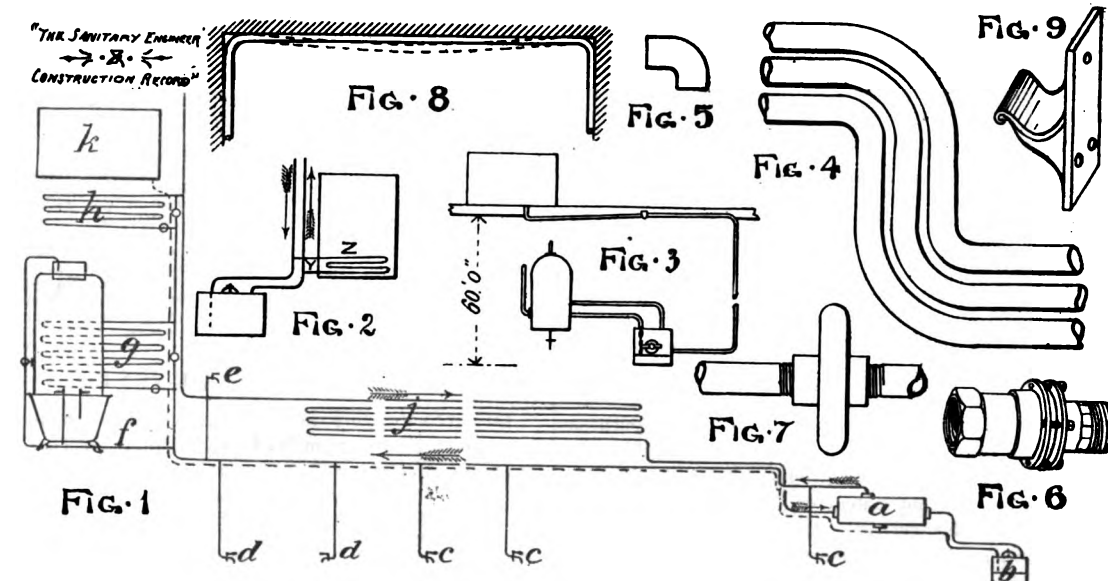
A great many hot-water men fix stop-cocks in the circulation-pipes, but this practice cannot be too strongly condemned. A few years ago a serious accident (?) occurred through this. The stop-cocks were closed while a new draw-off cock was being fixed, and it was forgotten to reopen them, with the result that when the fire was lighted the water in the boiler expanded sufficiently to burst it.

Elbows in circulation-pipes should always be avoided as much as possible, it being much preferable to have bends of an easy sweep or radius. Some first-class men will always insist on the pipes being heated and bent to suit the various positions, instead of using those bought at the manufacturers, the reason being that every bend, especially when made to a small radius, causes a retardation of the free flow of water, and as the force in the form of heat, which puts the water in motion, is very small, all obstructions and unnecessary friction should be avoided as much as possible. When galvanized-iron pipes are heated and bent the zinc coating is melted off. For common work no notice is taken of this, but for best work the pipes are bent first and galvanized afterwards. When done this way the bends should be carefully examined, as they have sometimes been found to be partly or entirely choked with zinc. Some men who take a pride in their work will make very nice bends, and when two or three are fixed together will make them match, so to speak, as shown at Fig. 4. Figure 5 is an elbow drawn for comparison with the bends. Mention has been made of the expansion and contraction of hot-water pipes. If no allowance is made for this motion of the pipes the result will be that some of the joints will leak, and this occurs more especially with long straight lengths. As expansion and contraction are, to a certain extent, irresistible forces, it follows that provision should be made to allow for them. The introduction of bends, as shown at Fig. 4, will allow for a great deal of motion of the pipes, and is a very simple and easy way of overcoming the difficulty. Figure 6 is a gland joint that can be used for the same purpose, the lining sliding in and out of the gland-box.

Figure 7 is, I think, an American invention and appears to be a simple and easily applied expansion socket, but not having used them the writer does not know how long they will last without breaking. But perhaps they are made of very tough but flexible iron and are as strong as the other parts of the fittings. In addition to expansion-joints it is important that the circulation-pipes should not be fixed by any branches, but this was referred to when writing on lead-encased tin pipes.

When hot-water pipes are fixed round and inside a room, they should not be too tightly fixed at the return ends, but should be kept at least one inch clear of the walls. Figure 8 explains what is meant, the dotted lines showing how the pipes will bulge out in the centre portion when expanded by heat. If the pipes are fixed clear of walls, as suggested, this would not occur, as the expansion would be expended at the ends. Neither should the pipes be too rigidly fixed by means of wall-hooks. Horizontal pipes should lay on brackets, which, although supporting, will not prevent them freely moving backwards and forwards. Lead pipes should lay on wood fillets, as stated in an earlier paper. Figure 9 is a neat brass or gun-metal bracket which can be screwed to a wooden block or lining board fixed to the walls. Long vertical pipes should be supported in the centre of the length, so that the expansion may be equally distributed at the ends.

(TO BE CONTINUED.)



the supervision of the writer. In the sketch, A is the cylinder fixed on brackets over a doorway; B is the boiler; C C C are taps over the scullery, servants' hall and butler's pantry sinks; d d are taps over lavatories; e is fixed to supply hot water to the housemaid's sink on chamber floor, and f to the spray and plunge bath; g is a coil for heating the bath-room, and is arranged so that towels, etc., can be dried or warmed; h is a coil on upper floor to warm a water-closet room and adjacent lobby. The waste heat is made use of by carrying the return-pipe through the housekeeper's room and the linen-room, the pipe being bent to form a radiator, as shown at j. It will be noticed that all the draw-off taps are branched into the flow-pipe, which is carried as direct as possible, and the coils or radiators are connected beyond the furthest tap so that the water may be drawn as hot as possible at the taps. The coils are so attached to the circulating-pipes that by closing three or four stop-cocks the water will flow round without passing through the coils, heat not being wanted in the rooms in the summer time. K is the cold-water supply-tank, and the service to the boiler is shown by dotted lines. The whole arrangement works very well. In this, and similar cases, it was found that after drawing sufficient hot water for a bath the heat from the coils fell considerably and some little time had to elapse before they got hot again. For this reason it is an open question if the pipes, etc., for supplying hot water to sinks, etc., and

the supply-pipe was sealed by the water in the boiler so that the air could not escape or be driven out at the bottom, although the cold-water cisterns were about sixty feet above the boilers. Great numbers of similar blunders could be given, but the writer does not consider it necessary to weary his readers by repetition of cases.

A common cause of complaint is that such a quantity of cold water has to be run to waste before hot water can be had at the taps. This occurs chiefly with long branch draw-off pipes to taps some distance away from the circulation-pipes. In a great many cases it is possible to fix return-pipes to these branches so that the water will circulate through them and thus avoid the evil referred to. Where it is impossible to circulate through the branches, the size of the pipes should be reduced as much as possible, so that less water will have to be run to waste. This applies more particularly to wash-hand-basins, where only a small quantity of hot water is required. For baths it is not so important to reduce the size of the pipes, as a few pints, or even a gallon, of cold water having to be drawn does not much matter, but if the pipe is reduced, the bather's patience would perhaps be exhausted by waiting for the bath to fill from a small pipe. In some cases it has been found to be an advantage to have two, or even three, sets of circulating-pipes carried from the cylinder to the various parts of a house, especially when the shape of the house is large and straggling, and the draw-offs are

EXAMINATION OF PLUMBERS IN WASHINGTON.

(From an Occasional Correspondent.)

WASHINGTON, D. C., September 20, 1887.

HAVING seen no report in THE SANITARY ENGINEER AND CONSTRUCTION RECORD of the operation of the revised regulations governing the registration of plumbers in the District of Columbia, I send you the following abstract of facts in the matter, in the belief that they will be of interest to plumbers who read your paper and to municipal officers.

The Board for the Revision of Plumbing Regulations and the Examination of Plumbers was appointed by the District Commissioners on April 6, 1887. It consisted of the following members: Samuel A. Robinson, Inspector of Plumbing (Chairman); H. F. Hayden, Superintendent of the Water Department; Dana C. Barber, Inspector of the Water Department (Secretary); R. G. Campbell, President of the regular Master Plumbers' Association of the District; and A. S. Dent, President of the Master Plumbers' Mutual Protective Association. The first work was the preparation of rules for the registration of plumbers, which, after revision by the Engineer Commissioner, were promulgated on April 23, as published in THE SANITARY ENGINEER AND CONSTRUCTION RECORD in the issue of April 30, Vol. XV. A supplementary regulation required the payment of a registration fee of three dollars. The time for the registration of masters was to expire August 31.

The number of applications during the first three months was comparatively small, only thirty-five out of over 100 known to be engaged in business in the District, and most of these were of the more intelligent of the craft, so that only four were rejected, though it is the general belief among the plumbers that those who "went up" first had an easier time than the late comers.

Previous to the first of August only one meeting a week was held for examinations. Usually not more than three candidates were examined—frequently four, but never more than six—at a single session lasting nominally from 7:30 to 9 P. M., but frequently prolonged till 10 or even 11 o'clock. Each candidate was examined separately, with no others present. In making appointments, a half-hour was usually allowed to each, but this time was frequently extended, sometimes to more than a full hour, especially when there were but one or two candidates at a session.

The examinations were wholly oral, excepting simple blackboard sketches, mainly for illustration. The questions were both on theory and practice—design and workmanship—and varied in each case from every other, no regular form being followed, though of course the same question was often asked different candidates.

Some of the more common points of deficiency were: The cause of the circulation of air through the house-drainage system; the effect of wind blowing across the tops of soil-pipes and fresh-air inlets; the grade for the main drain; methods of supporting soil-pipes; size of trap-pipes and the effect of sharp bends in the same; methods of trapping area drains, and construction of joints in cast-iron and earthenware pipe.

As the less intelligent men came up, late in the season, it was found that many skilled and honest workmen were too deficient in elementary physics to pass satisfactorily, and in such cases the board recommended that the candidate's application be refused, but that he be allowed to continue in business (if he was already in business) for three months (the required interval before a second examination is allowed), in the belief that in that time he would qualify himself—and the Commissioners in all cases approved such recommendations.

In August the board held meetings for examination nearly every night, and fifty-two applications were disposed of. At the end of the month (expiration of the limited time), sixty-four had been authorized to register, fourteen rejected but allowed to continue in business during the required interval before a second examination, and ten rejected absolutely, of whom two were not called for examination, being unable to read or write, and one rejected without examination, for appearing in an intoxicated condition. One who early in the season failed to pass satisfactorily, tried it again after three months of hard study and was successful.

As many plumbers known to be carrying on the business had not applied for examination, while many who had

passed successfully had not registered, the Commissioners extended the time for registration to September 10, and ordered that after that date no permits be issued to unregistered plumbers.

At the close of office hours on the 10th the record stood: Applications, 97; authorized to register, 67; rejected, but allowed to continue three months, 17; rejected absolutely, 13; registered, 54.

At this date nearly all who have been authorized to register have done so, but few new applications have been presented. There remain, perhaps, a dozen master plumbers who have not applied for examination. They are preparing, it is said, to contest the legality of the regulations, together with some who have been rejected.

Applications were frequently made to the chairman early in the season for information as to the best books to study in preparation for the examination. Of the several recommended, I suppose none was so generally bought and eagerly studied as your "Plumbing and House-Drainage Problems."

The revision of the plumbing regulations has not yet been completed, nor has the examination of journeymen been inaugurated.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

USING OIL OR GAS UNDER BOILERS.

WASHINGTON CITY, September 17, 1887.

SIR: I have a No. 4 Dunning boiler, low-pressure steam (agents, Littel & Co., 40 Cortlandt Street), and want to use gas or petroleum for fuel instead of coal. I have written to several parties, but have not got exactly what I would like. I have written to-day to a number of advertisers in THE SANITARY ENGINEER AND CONSTRUCTION RECORD, but think it best to write you to ask if you know of any such arrangement, and address, or any book on the subject. I have your books on steam-heating and plumbing hints. Do you think your correspondent "Thermus" could assist me? If so his name and address or that of any one that you think could aid me. I want to make the test at once before I put plants in my house (October 15). I will be obliged for any assistance you can give me as soon as possible. Yours truly, WRIGHT RIVES, P. O. Box 279.

[If our correspondent desires to burn gas under a boiler we must refer him to the methods pursued by the users of natural-gas at Pittsburg and vicinity, which appeared in our issue of January 15, 1887.

With regard to the use of oil we know little, though there are several burners in the market for this purpose that can be introduced into a boiler furnace and lay on the grates. Oil and air are introduced through different openings, and a recent patent on this subject is on the principle of the fuel cartridge, the oil being fed through the porous material from a reservoir and air admitted between the rings.

"Thermus" informs us he has had no experience with oil, and with gas his knowledge is limited to the use of natural-gas.

Presumably, some of our readers may be able to send Mr. Rives their experience in the use of gas and oil, and we would suggest correspondence with the makers of the boiler—N. Y. Central Iron-Works, Geneva, N. Y.]

WARMING WATER FOR BATHS IN SOLDIERS' BARRACKS.

OFFICE OF THE ACT'G ASS'T QUARTERMASTER, } WILLETS POINT, N. Y. HARBOR, September 23, 1887. }

SIR: Will you kindly tell me where I can get a simple and cheap water-heater that could be placed in soldiers' barracks, connected with water system (pressure in main sixty pounds), to heat water for bathing purposes, etc.? It is to perform the same office as the water-back and reservoir attached to a range for supplying hot water to plumbing fixtures in houses. Very respectfully, IRVING HALE,

First Lieut. Engineers, A. A. Q. M.

[It is not clear to us whether our correspondent intends to use the heat of a fire or the heat of steam for warming the water.

If the heat of fire is intended, he may use any of the small hot-water boilers used for warming purposes and connect it with either a closed or open tank, so as to circulate in the ordinary manner. If an open tank is used a ball-cock must be used within it to keep the water-level

constant and the tank should be as high up as possible, as only the pressure from this tank will be exerted at the faucets.

If a closed tank is used, it can be placed a few feet above the boiler, using good large circulating pipes, and the pressure of the water-works maintained upon it. Some of the makers of hot-water boilers make a small apparatus for use with an ordinary kitchen boiler.

If the heat of steam is to be utilized, the custom in New York among steam-heating firms is to provide a closed tank, say three feet in diameter by five or six feet long, with a manhole and cover in one head. It may be of ½-inch thick iron, with ¾-inch or 1-inch heads, and requires no bracing if only for sixty pounds water-pressure. This can be purchased for about \$90 of a boiler-maker.

Within this tank place about four turns of 2½-inch brass pipe, with brass bends to form a coil, bringing the ends through the head of the tank opposite to the manhole and fastening them with lock-nuts. Use exhaust-steam in this coil if you have it to spare; if not, use live.

It is a good method to fit the coil up for the use of either live or exhaust steam, using the latter when you have it and turning on the live at other times.

The addresses of a number of makers of hot-water heating boilers will be found in our advertising columns.]

STREET SWEEPINGS AS A FERTILIZER.

FLUSHING, L. I., September 20, 1887.

SIR: In a late issue of your paper an inquiry was made in regard to the results of the application of street sweepings to land. For the last fifty years it has been used on Long Island for all kinds of crops, and is considered about equal to horse manure, that collected from streets downtown (New York) being the best. It is excellent on light soils and should be spread broadcast after plowing and harrowed in. It is very good as a top dressing for lawns and meadows. It costs, delivered by boats to nearest dock on Long Island, about \$1 per two-horse wagon load.

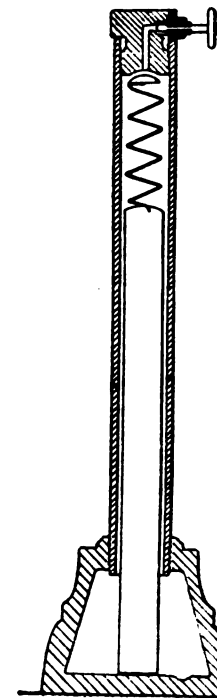
Respectfully, F. R. S.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

STEAM-RADIATOR AIR-VENT.

THE accompanying sketch illustrates a novel method, just patented by Gordon W. Lloyds, architect, of Detroit, Mich., for preventing the escape of water through the air-vents of a steam-radiator.



It consists in a float being introduced into a vertical pipe of the radiator, to the upper end of which there is a disk attached by a spring or suitable elastic substance. This disk conforms to a seat, within a plug or suitable equivalent, at the top of the pipe, thus forming a valve. Should water rise within the radiator from any cause, the float lifts the disk and closes the valve, thus preventing an overflow.

In this same plug or cap, at the head of the pipe, the air-cock is also placed, and the prime object of the invention is to stop the escape of water from the air-vent, should the latter be forgotten, or should it be opened while the radiator was full of water.

The expansion of the float-cylinder—which is made of a metal with a greater coefficient of expansion than iron—is also taken advantage of to close the escape against steam when the air has been driven from the pipes.

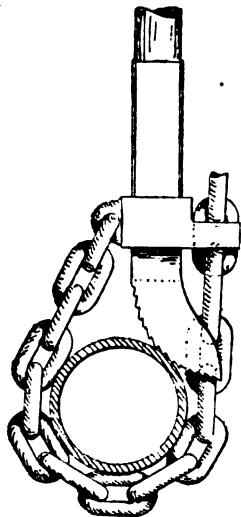
CHAIN-TONGS.

THE accompanying sketch shows a novel improvement in chain-tongs for screwing or unscrewing pipe lately patented by

William Gormesly, of Chicago, Ill.

The apparatus consists of a lever, with the usual serrated end to engage the pipe, and a chain to wrap about it, and wherein it differs materially from the ordinary chain-tongs is in having a movable collar on the lever to which the chain is attached at the back by an eye and in the front in the usual manner between two prongs. The invention consists in the adjustment of the collar on the lever, the object being to secure finer adjustment of the chain about the pipe than can be

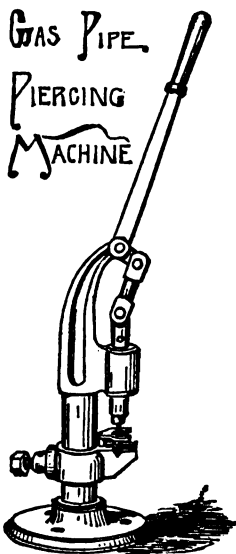
obtained by moving it the length of one link. Its use is obvious to a pipe-fitter.



GAS-PIPE PIERCING MACHINE.

THE *Engineer* thus describes a machine for punching holes in gas-pipes for illuminating devices, for which there was a great demand for the recent jubilee:

"With a view to the large quantity of work which will be required for the general illuminations of this month, the piercing machine illustrated below for perforating the



copper tubes for making gas-illumination devices will be of interest to many readers. It is not only a labor-saving, but what is more important in these matters, a time-saving contrivance. The holes made by it are, moreover, regular in size, and are all pierced straight and true."

It is made by Messrs. Winn & Co., of Birmingham.

ANNUAL REPORT OF THE BOARD OF PUBLIC AFFAIRS OF CINCINNATI.

THIS report covers that of H. J. Stanley, Chief Engineer, and his assistants, T. A. Ridgway and A. E. Tripp. The expenses for salaries in the Engineering Department were \$38,531.67, and for office expenses, horse hire, etc., in same, \$6,358.

The total cost of works completed during the year 1886 was \$1,161,971.62, and the estimated cost of works projected, \$2,078,755.81, the total being largely in excess of the work of any previous year.

The sewers built during the year were less in length than the average, being 2 1/8 miles, making the total length of sewers now laid to be 47 1/2 miles; 818 sewer connections were made during the year.

The total miles of gas mains in the city is nearly 256 miles, and the average cost of gas per lamp for street lighting for the year was \$22.54, and for 1,000 feet of gas for the same, \$1.1244; this is about two-thirds only of the average for the five cities—New York, Pittsburg, Baltimore, Louisville, and New Orleans, the average by months for New York being \$1.72. Gasoline lamps cost by the year \$24.14 each, 1,314 being in use.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
September 24.....	25 47	21.06	22 91	30.06	28.90	23.54	30.16

E. G. LOVE, Ph.D., Gas Examiner.

THE largest gas-receiver in Germany, which will hold 50,000 cubic metres of gas, is that at Grasbrook, and cost 814,000 marks. It was designed by Herr C. Haase, of Hamburg, who gave a description of the receiver before a recent meeting in Hamburg of the German Society of Gas and Water Works Men.

CORROSION OF METALS.

CONSIDERABLE difficulty is experienced by mining engineers in procuring metal which will not easily corrode in contact with the acid waters in mines. Experiments have been made in Germany with various metals, among others being Delta Metal, as manufactured by Mr. Alexander Dick, of 110 Cannon Street, London. We are informed that the Bonifacius Coal Mining Company of Westphalia, had great trouble in this respect owing to the acid waters quickly corroding the iron and steel of the underground machinery, therefore they determined to make a series of experiments with the view of finding the relative corrosion

CORROSION OF METALS



of metals of suitable strength. Brass and gun-metal were not strong enough, and hence they had trials with steel, iron, and Delta Metal. Rolled bars of each of these were immersed during a period of six and a half months in the water issuing from the pits at Kray, and then carefully re-weighed and photographed. The bars were 7.5 inches long and had a sectional area of 0.62 square inch. We give weights of three kinds of bars before and after the trial and the condition after the tests is shown by the accompanying engravings. In consequence of the rapid corrosion of iron and steel, Delta Metal is now used instead for underground machinery in this and other mines.

	Wrought Iron.	Steel.	Delta Metal.
Weight of bars when put in.	lb. 1.1805	lb. 1.2125	lb. 1.2787
After 6 1/2 months.....	0.6393	0.6614	1.2633
Loss.....	46.3%	45.45%	1.2%

—The Gas Engineer.

A LESSON TO BRIBERS.

MR. WILLIAM F. TAFTE, one of the recently appointed inspectors of plumbing under the New York Board of Health, has rendered a public service and taught bribers a wholesome lesson in securing the arrest of two men who sought to bribe him to pass some defective work. Mr. Taffe, when approached, reported the fact to the Department and was referred to Police Inspector Byrnes, who instructed him to receive the money and mark it in order that the bribers might be identified. This was done and these men, Barrett Harris and Bernard Bloomberg, were arrested. The board, at its meeting this week, passed resolutions thanking Mr. Taffe for his plucky conduct in the matter. He certainly deserves commendation, for it requires more pluck to expose men of this sort than it does to refuse the bribe, and his action will no doubt have a wholesome effect in this city; at any rate, it will teach a certain class of men that every man that holds a public inspectorship is not necessarily venal.

EIGHTH ANNUAL REPORT OF THE BOARD OF HEALTH OF THE CITY OF ATLANTA FOR THE YEAR 1886.

THE vital statistics of Atlanta do not appear to be satisfactory as to accuracy and completeness. The board estimate the annual death-rate among the whites at 10.10 and among the colored at 23.71 per 1,000. Evidently either the population of the city is much overestimated or a considerable number of deaths are unrecorded, for it is so extremely improbable that the death-rate of the white population in a city like Atlanta should be less than 16 per 1,000 that any less rate should at once lead to doubt of the figures employed.

The sewerage of the city is still under consideration, and the board recommend that Mr. Ernest W. Bowditch, of Boston, be employed to prepare plans.

It also advises the enactment of a set of plumbing regulations. The reports of the inspectors show that a large amount of garbage and night soil has been removed during the year, and that good work has been done in the suppression of nuisances. The total cost of the Health Department during the year was \$23,818.45.

SYRACUSE HEALTH OFFICER'S REPORT.

THE first paper in the third annual report of the Board of Health of Syracuse, N. Y., is the report of the Health Officer, Dr. John Van Duyn. After remarking that the vital statistics of the city are incomplete, but that steps are being taken to make them more satisfactory, he gives the death-rate for the past year at 15.57 per 1,000. This is a very low mortality—suspiciously low, in fact. Of the 1,059 deaths reported, 176 were due to consumption, 18 to diphtheria, and 34 to typhoid fever. He states that "a comparatively small part of the city uses the water supplied by the water company. The supply does not reach far beyond the central low-lying districts of the city." The sewerage system is declared to be in a rude and undeveloped state and without satisfactory ventilation. The bad condition of Onondaga Creek, which is practically an open sewer, is referred to, and the city government is warned that it is in danger of creating a similar nuisance in Harbor Brook. Dr. Van Duyn says: "Most houses here are built on speculation, and the principle which rules the construction of the drainage is concealment of evil and economy of expenditure. In all cases that came under my observation nearly every principle of safe construction was violated; too large and porous pipes, straight pipes set in sharp angles, insufficient cementing of joints, poor, cheap, and insufficient traps, no ventilation, etc.; so that when the houses were completed they became at once sources of danger to the inmates."

The report of the Health Inspector, W. H. Pohlman, shows that 15,863 loads of garbage were removed during the year, and that 3,442 nuisances of various kinds were abated. He remarks that "the greatest evil that exists in our city is the great number of privy-vaults and cess-pools, the contents of which leach into and contaminate many wells."

The total expense of the removal of garbage for the year was \$16,579.57, and the amount received from its sale was \$232.50.

The report shows that the Health Department has been active, and that there is plenty for it to do in the near future.

THE AMERICAN MACHINIST.

OUR valued contemporary, the *American Machinist*, announces that Fred. J. Miller, a mechanic and engineer of recognized ability and a former contributor to its columns, has relinquished an excellent position in a large manufacturing establishment to accept a position on the editorial staff of that paper. Mr. Miller will devote his entire time to the mechanical department.

THE ARCHITECTURAL LEAGUE PRIZE COMPETITION.

THE Architectural League announces that it has instituted, in connection with its exhibition, an annual competition, open to all draughtsmen in the United States under the age of twenty-five. The object of such competition to be the promotion of good design and the improvement of draughtsmanship.

As prizes, it offers to the design placed first, a gold medal, to be known as The Gold Medal of the Architectural League; and to the design placed second, The Silver Medal of the Architectural League.

The conditions for admission to the competition are:

First—That the competitors shall be residents of the United States, and under the age of twenty-five; and—

Second—That the drawings shall be made in conformity with the following programme, and, in all parts and portions, entirely by the hand of the competitor.

The drawings will be judged by a jury appointed for that purpose.

The successful drawings, and such others as may be thought worthy, will be hung at the exhibition, the first and second prize drawings being so indicated, and these latter shall thereupon become the property of the League.

The following is the programme:

The drawings shall exhibit a "Memorial Clock and Bell Tower on a Village Green."

The tower to stand on a base which shall not exceed the dimensions of a square of twenty-two feet.

Each contributor to exhibit two sheets of drawings: one to contain plans and elevations at the scale of four feet to the inch, and one to exhibit a perspective view. The plan and elevation sheet to be finished in line with India ink and the lining pen. No brush-work on this sheet, except in blacking in windows and sections. No shadows are to be cast. The perspective sheet to be rendered at will. Each sheet to be cut to the uniform size of 24 by 32 inches, and to be white card or Bristol board, or Whatman paper, mounted on stretcher. No colored borders, frames, or glazing will be allowed.

Each sheet must be distinguished by a motto or cypher. A sealed envelope, bearing the same motto or cypher, must contain the name and full address of the author.

Drawings are to be delivered flat, carriage paid, on or before December 5, 1887, to Charles I. Berg, Secretary, 152 Fifth Avenue, New York City. They will be returned at the close of the exhibition at the expense of the contributor.

Messrs. William C. Hazlett, John L. Dufais, and Charles I. Berg are the Committee.

Further information may be obtained by addressing Charles I. Berg.

KANSAS CITY CHURCH COMPETITION.

THE design over motto "Black and White," of Mr. Adriance Van Brunt, of Kansas City, Mo., has been placed first in the competition for the new Grace Church in that city.

ENGINEERS' CLUB OF PHILADELPHIA.

A MEETING was held June 18, President T. M. Cleemann in the chair; 11 members present.

From record of last meeting, held June 18, we learn that members were elected as follows:

Active Members—Messrs. W. H. Frances, P. Doyle, John C. des Granges, and Francis W. Whiting.
Associate Members—Messrs. Robert Neilson and Horace B. Powell.

The following resolution was unanimously adopted: *Whereas*, The club has examined United States Coast and Geodetic Survey Chart, No. 3694, of the Hudson and East Rivers in the vicinity of New York, scale 1:100,000, with a view of considering the value of a proposed similar chart of the Delaware and Schuylkill Rivers, near Philadelphia; *Resolved*, That the club is highly pleased with this form, arrangement, and scale, and have no amendments or

changes to suggest, and believe that such a chart of the Philadelphia rivers would be of great value to the profession and the public.

Mr. John L. Gill, Jr., presented a description of a new system of screw threads which he had arranged, and asked that a committee be appointed to examine and report upon the same. The president appointed the following committee: Messrs. Henry G. Morris, Chairman, John T. Boyd, Professor L. M. Haupt, Washington Jones, and M. R. Mucklé, Jr.

The secretary presented, for Mr. E. L. Cortbell, an illustrated account of a Venetian ship railway.

For Mr. C. H. Middleton, Jr., an interesting letter descriptive of camp life on the Union Pacific Railway Surveys.

For Mr. R. Meade Bache, an illustrated description of a boat telemeter.

Mr. S. P. Mitchell presented an illustrated description of the Susquehanna River Bridge of the B. & O. R. R.

Howard Murphy, 1,122 Girard Street, Secretary and Treasurer.

RIVER AND HARBOR IMPROVEMENTS IN MASSACHUSETTS AND RHODE ISLAND.

MAJOR W. R. LIVERMORE, in his report to Chief of Engineers, submits an estimate for next year's expenditure at Hyannis, Mass., of \$35,662; at Nantucket, \$50,000; at Wareham, \$16,236; for Pawtucket River, \$50,000; and for Providence River and Narragansett Bay, \$100,000. Of Newport Harbor he says the objects of the improvement are to widen and deepen the southern (main) entrance, enlarging its capacity for vessels seeking refuge in storms by increasing the area and depth of anchorage. In dredging the harbor and widening and deepening the entrance, \$42,000 have been expended, and \$52,000 is the sum estimated to be necessary to complete the projected work, of which \$30,000 can be profitably expended next year. For next year's operations at the Harbor of Refuge at Block Island, \$53,189 is asked; \$33,000 for Stonington Harbor, and \$26,637 for Pawtucket River. The importance of the work at Harbor of Refuge at Vineyard Haven is set forth. Estimates amounting to \$3,983,936 are submitted.

M. EIFFEL, the projector of the Tower of Babel for the Paris Exhibition, is no novice in the matter of huge engineering constructions. He made the framework of Bartholdi's "Liberty," and executed the grand vestibule and the principal facade of the Paris Exhibition of 1878, a work which came to three million francs. One of his principal works is the bridge which he erected over the Douro at Oporto, on the Lisbon Railway, in 1876, which is, indeed, one of the finest specimens of engineering skill in Europe. The river is spanned by a magnificent arch of 160 metres at a height of 61 metres from the river, and is executed with a view to the artistic effect as well as its stability. This bridge cost a million and a half francs. Another remarkable work of M. Eiffel is the railway viaduct of Parabit, over the valley of Truyère, in the middle of France, which cost 3,248,000 francs. Here the opening of the arch is 165 metres, and the height above the water 124 metres. He has also constructed some railway bridges and viaducts remarkable for their length, such as a bridge at Szeged, in Hungary, which is 606 metres long, and one at Vianna, in Portugal, which is 736 metres. —*The Architect*.

POSTAL TUBE BETWEEN DOVER AND CALAIS.

M. A. ARNAUDEAU, a French engineer, proposes to construct a postal tube of sheet iron between Dover and Calais, to be suspended from pillars 800 metres apart.

The tube is to be one metre in diameter, and to contain a little railroad on which a train of from 10 to 15 cars, each weighing when loaded 500 kilogrammes, is to be driven by a pneumatic tube. The piers and pillars are to be constructed to carry four such tubes, and the greatest depth of water in which any one of them will be placed is estimated at 60 metres. Each tube with its contents is to weigh 125 kilogrammes per metre of length, the total length being 32 kilometres. The pillars from which the tube is suspended are to be of iron trellis-works and to rise 110 metres above the water. The total cost is estimated at 25,000,000 francs.

THE PARIS SCHOOL OF FINE ARTS.

ARCHITECTS will be interested in the article under the above title by Henry O. Avery in the *Scribner's Magazine* for October. Among the seventeen illustrations are portraits of five of the professors.

FOURTH ANNUAL REPORT OF THE TRUSTEES OF THE FREMONT, OHIO, WATER-WORKS.

This report contains just enough information about the water-works to make us wish for more. It appears that a portion at least of the supply is derived from ground-water collected by tile-drains laid in a bed of saturated gravel. It is not stated how deep these pipes are laid, nor what their total length and the area of the gathering ground are. It is stated, however, that a recent addition of 2,530 feet of 6, 8, and 9 inch tile did not materially increase the yield, as the water-surface in the gravel has been lowered. This looks as if the demand had already outgrown the yield of the gravel. In February and March the gathering ground was overflowed and the water furnished was turbid. This looks as if the pipes were not laid deep enough.

There are 275 taps, using 359,665 gallons a day, or 1,308 gallons per day per tap. This is very much in excess of what is really needed and is extravagant and expensive.

The water is pumped into a stand-pipe, a cut of which is given, but its height and size are not given, neither is there any information as to the size of pumps used. The fuel used is coal, natural gas, and crude petroleum. The latter is used with atomizing spray burners, and the engineer, Mr. C. F. Reiff, thinks that it is more economical than bituminous coal.

The Secretary, Mr. Joseph Schwartz, reports the cost of maintenance for the year as \$3,690.15 and the revenue \$5,217.

The works have cost \$143,854.69.

CAPTURE OF A BOA IN A SEWER.

SOME sewer men met with a strange adventure while at work one night in one of the labyrinths of subterranean Paris. As they were busily engaged in cleaning out that part of the metropolitan cloaca which is under the Boulevard de la Villette, they suddenly hear a loud and prolonged sound of hissing, which some of them took to be the cries of a person in distress, who had, perhaps, fallen into the drain at one of the open points. Redonnet, the foreman of the gang, thought, however, that the strange noise was caused by evil doers, who were probably hiding in the sewers from the police; so he took up his shovel and marched boldly toward the spot whence the sounds proceeded. After having proceeded a considerable distance, he saw by the dim light of the sewer-lamps an enormous boa constrictor coiled around one of the water-ducts, with its head protruding toward him. Redonnet immediately stunned the reptile with a vigorous blow from his shovel, and, his workmen having come up, the whole party set to work until they battered the life out of the ill-fated and imprudent boa. The remains of the reptile were then carefully collected and borne in triumph to the surface of the earth, and then to the nearest police station, where, it appears, the boa was "wanted," as it had managed to escape from the menagerie of a wandering showman, who had been exhibiting his "fearful wild fowl" to the inhabitants of the municipal boroughs of La Villette and La Chapelle.—*N. Y. Times*.

LIME-KILN CLUB SANITARY ITEMS.

(From the *Detroit Free Press*.)

THE Secretary of the State Board of Health of Illinois wanted to know what progress, if any, the colored people of Michigan were making in sanitary matters. Brother Gardner said he would like a general discussion of the subject, and Sir Isaac Walpole arose to remark that he was making progress. Up to a year ago he didn't know that seven persons and a dog sleeping in an 8x10 room with all the windows down and the doors closed was injurious to the human system. He supposed the feeling of languor was brought on by non-circulation of blood in the feet.

Whalebone Howker had also progressed. He had now learned the difference between the smell of gunpowder and sewer-gas, and the lives of his thirteen children were no longer in peril.

Pickles Smith used to wash his feet once in six months. Now he felt conscience-stricken if a week passed over his head that he didn't heat up a boiler of water and soak up his pedals. His five dogs used to sleep in the house. Now they either made their beds in the doorway or stood up against the wood-shed door.

Judge Chewso had slept in a room with six other persons, a barrel of soft soap, three dogs, an old codfish, and a limburger cheese, but he had progressed. He used to wake up in the morning and charge the Democratic Party with seeking to poison him, but now he realized that it was his ignorance of sanitary precautions.

Several other members spoke in the same strain, and related vivid personal experiences, and the president finally said:

"De secretary will answer to de effect dat we ar' improv'in' in sanitary matters in de rapidest manner, an' dat de time am party nigh at hand when a black pusson sleepin' in de garret of a house doarin' de hot nights of July an' August will werry probably remove de feather bed an' dispense wid about fo' comforters."

PERSONAL.

G. W. F. SHERWIN, C. E., who made the survey of the Northern Missouri Railroad and laid out the towns of Sioux City and Niobrara, Neb., died last week at Erie, Pa. Mr. Sherwin was Water Commissioner of Erie.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

THE time for receiving the plans and specifications for a building on John and Jackson streets, Hamilton, Ont., has been extended from September 15 to October 12.

A. S. DRAPER, State Superintendent of Public Schools of New York, under authority of an act of the last legislature, offers \$975 in prizes for best designs for school-houses, cost not to exceed \$600, \$1,000, \$1,500, \$2,500, \$5,000, and \$10,000 respectively. Full particulars can be obtained by addressing Professor Draper at Albany, N. Y. A committee, consisting of ex-State Superintendent W. B. Ruggles, Professor J. W. Kimball, Superintendent Charles E. Gorton, Principal E. H. Cook, Dr. G. A. Bacon, Willis R. Hall, and Albert W. Fuller, architect, will examine the designs and designate the two in each class which in their judgment possesses the most merit.

ENGINEERING COMPETITIONS.

ENGINEERS and contractors are asked to furnish plans and specifications for the construction of the work necessary to the straightening and changing of the channel of the Rio Grande River, and the building of a levee at and near Alamosa, Colorado, until 12 o'clock M., October 15. For further information address J. S. Greene, Secretary Board of Construction, Denver.

ESTIMATES are wanted until October 20, from civil engineers, for surveying about 64 miles of railroad with about 40 miles of extra survey at Hayneville, Alabama. Bids must not exceed \$900. References will be required. For further information address W. Brewer.



For works for which proposals are requested see also the "Proposal Column," pages 477-481-483-484-497.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE SANITARY ENGINEER AND CONSTRUCTION RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER, SEWERAGE, ETC.

MT. CARROLL, ILL.—See our Proposal columns for information respecting a system of water-works to be constructed here.

HASTINGS, NEB.—The sewerage question is still unsettled, and experts are now considering the matter.

SAVANNAH, GEO.—Dissatisfaction is expressed with the artesian-well water-supply. It is possible that more wells may be bored.

WASECA, MINN.—An artesian well is wanted.

ORTONVILLE, MINN.—Special city election by large majority decided to put in \$10,000 water-works.

GENEVA, N. Y.—Messrs. Chambers and Casey, contractors, of Rochester, N. Y., have been awarded the contract for building the pumping station (except the smoke stack) for the Geneva Water-Works Company. Price, \$6,500.

STROMSBURG, NEB.—The vote to bond this town for \$12,000 for a water-works system was unanimously carried, only one vote being cast in the negative.

JOHNSON CITY, TENN.—A contract has been entered into with C. M. Corpening, of N. C., to put in a water-works system in this town. It is expected that work will be begun within ninety days.

EAST JORDAN, MICH.—is discussing the water-works question; \$10,000 is the amount spoken of.

DAVID CITY, NEB.—The contract for the construction of a system of water-works for this place has been awarded to Messrs. Schroeder Bros.

MONTROSE, COL.—The Town Board considered the proposition made by Mr. Charles E. McConnell, of the Uncompahgre Valley, to supply the town of Montrose with pure water. The proposition was submitted last week to a vote of the taxpayers at a special election and accepted, there being but two negative votes.

WINFIELD, KAN.—The water system will be extended by several miles of water-mains.

PETERSBURG, ILL.—The City Council has awarded the contract for a system of water-works to D. Fisher, of this city. The cost of the works will be \$20,000. The work to be completed January 1 next.

MANKATO, MINN.—This city is extending her water-works plant.

GREENVILLE, O.—Our correspondent writes: "A proposition was made by Messrs. Lewis Comegys & Co., of New York, to construct and maintain water-works in this city, with seventy-five hydrants for fire purposes, for an annual rental of \$3,500. An ordinance was passed accepting the proposition, and an election was ordered for confirmation or rejection by electors. Before the time for said election had arrived, however, owing to the great public clamor against the improvement, Messrs. L. C. & Co. withdrew their proposition, and the matter was dropped." A special election will be held October 12.

NORFOLK, NEB.—Our correspondent writes: "The contracts for our water-works have been let and active operations will be commenced in a few days. A. L. Strang & Co., of Omaha, will build the system. It will be a direct pressure and stand-pipe system."

BONHAM, TEX.—advertisers for bids for a system of water-works. For further information address Mayor, Bonham, Tex.

WARE, MASS.—Plans are being prepared by Engineer Davis, of Northampton, for a new sewerage system.

CRETE, NEB.—The City Council is considering bids for water-works. It is expected that the contract will be made in favor of the Strang Co., of Omaha.

SALISBURY, MD.—J. B. Cloud & Co., N. Y., will build water-works costing \$25,000.

VINEYARD HAVEN, MASS.—Water-works will be built here.

CLYDE, KAN.—E. Sutphen, of this city, will build water-works at Greenleaf, Kan.

ELLENBURG, WASH. T.—is discussing the subject of water-works.

WASHINGTON, GEO.—A proposition to build water-works is wanted. The town has appropriated \$10,000.

GALLATIN, TENN.—A water-works system is being discussed.

GALLIPOLIS, O.—will vote on the question of a town water-works shortly.

TOLEDO, O.—A considerable amount of sewerage-work is to be done here.

TOLEDO, O.—A resolution has been introduced in the Council looking to the boring of an artesian well.

ATHOL, MASS.—Owing to legal complications, it is doubtful whether anything can be done at present in regard to the proposed sewerage scheme.

FORT FAIRFIELD, ME.—Our correspondent writes: "The prospect now is that we shall have water-works put in here next year, as the contract is all made."

WEATHERFORD, TEX.—Our correspondent writes: "We are corresponding with various water-works companies with a view of granting a franchise to some reliable company, but have not yet received any proposition from any company. Our city will grant a long-time franchise, and pay not less than \$1,000 per annum for fire protection, and more if the works are so constructed as not to necessitate the city to keep a fire-engine. Our population is about 4,000. Taxable property in 1886 was \$1,186,300 more this year."

HATFIELD, KAN., will have an artesian well.

A COMPANY is being formed to run an irrigating ditch from a point near Coolidge through northern part of Hamilton, Kearney and Finney Counties, Kansas.

OMAHA, NEB.—The Omaha Water-Works Company will lay water-mains and pipes in various parts of the city.

EAST TAWAS, MICH.—The Michigan Pipe Company, of Bay City, Mich., will put in the water-works at this city for \$28,000.

ENNIS, TEX.—Our correspondent writes: "Our city voted on the question of taxation for water purposes September 20, which resulted in 20 to 1 in favor of taxation. The work is in the hands of the Aldermen; the first attempt will be for an artesian well. The tax will be levied this year."

SALISBURY, MD.—Our correspondent writes: "Nothing has been done in regard to the water-works for this place."

ALBION, MICH.—Our correspondent writes: "Nothing doing at present; water-works system merely talked. No election held as yet. Will advise should the matter come to an election."

CAMDEN, N. J.—The question of the awarding of a contract for a filter has been postponed.

LA SALLE, ILL.—The estimated cost of the new water-works system at this place is \$121,000.

ONEIDA, N. Y.—Mr. Walter Randall, of Walton, and Mr. Jerome B. Tuckerman, of Eaton, will make surveys here for the purpose of constructing a system of sewerage, which will be introduced as soon as possible.

MILWAUKEE.—A 36-inch sewer will be built on the South side, from Reed Street to Starke's Slip. Water-mains will be laid on Cherry Street, from 20th to 24th Streets (4 blocks).

WILLIAMSBURG, IA.—Our correspondent writes: "Nothing has been done in regard to a water-supply except to bore a deep well, put in a pump, and erect a windmill to supply water at the corners of the square for watering teams and for drinking purposes. We are not able to do anything more at the present; probably will not before two years."

JACKSONVILLE, ILL.—The people of this city are said to be disappointed in the quality of the water-supply obtained through the artesian wells.

LAKE CITY, FLA.—At the last session of the City Council a charter was granted to Noyes S. Collins for the extension of the water-works system for this place.

MONTPELIER, VT.—At a special village meeting, September 26, a vote was passed to lay another water-main pipe from the reservoir in Berlin, at this place. The Treasurer was authorized to borrow a sum, not exceeding \$30,000, to meet the expenses.

COSHOCOTON, O., September 28, 1887.—Our correspondent writes: "We have let the contract for water-works under the franchise system to American Water-Supply Co., of McKeesport, Pa., providing it carries at the next special election, to be held next month."

CARSON CITY, MICH., has voted \$5,000 for water-works.

BESSEMER, ALA.—The water-works contract has been awarded to Scoville & Irwin, of Nashville, Tenn.

FOSTORIA, O.—Messrs. Ferris & Halliday, of Jersey City, N. J., have been awarded the contract for the new water-works at this place.

LANCASTER, PA.—See our "Proposal Columns" in regard to water-works for this place.

DULUTH, MINN.—The Gas and Water Co. contemplate building a high-service reservoir next season.

BENICIA, CAL., is not satisfied with its present water-supply.

McKEESPORT, PA.—Messrs. Snyder, Wilson & Co. have been awarded the contract for erecting a 5,000,000 gallon pumping engine.

EVANSTON, ILL.—The plan submitted by Mr. Grover for supplying North Evanston with water was adopted at the last meeting of the Trustees.

OAKLAND, CAL.—It is reported that the Contra Costa Water Co. will sell its property to the city for \$4,500,000.

MIDDLETOWN, N. Y.—The Anglo-Swiss Company are constructing a storage-reservoir for water, which will hold about 300,000 gallons.

SPRINGFIELD, ILL.—Colonel Hamer, representing a New York firm, is considering the proposition to purchase the water-works plant. If this is done, it is proposed that the city give the company a water-right and the privilege of improving Clear Lake by dredging and enlarging it, when a new system of water-works will be put in to supply the entire city. The city will be expected to take a specified number of hydrants at an agreed price. Pipes are to be laid throughout the city, and, after the completion of the new works, the city is to have the option of purchasing the plant.

MT. CARMEL, ILL.—The Mount Carmel Development Company has been incorporated; capital stock, \$3,000,000; to construct, maintain, and to operate a hydraulic canal from a point on Crawford Creek to Mount Carmel, for the purpose of supplying the city with water. Incorporators, Robert Bell, E. H. Green, S. Z. Landers, Amos Green, Theodore Green.

PHILADELPHIA, PA.—The Haverford Water Company and the Radnor Water Company have each increased their capital stock to \$100,000, and the Merion Water Company to \$500,000. The increases are said to be for the establishment of water-works in the suburbs.

LYNN, MASS.—At the last meeting of the Aldermen the report of the Committee on Water Supply, that the public board be instructed to purchase between 30 and 40 acres of land on the water-shed of Breed's Pond, was adopted. The land will cost about \$400 per acre.

FRANKLIN, NEB.—The new water-works for this place will be built by the Strang Company, of Omaha, Neb.

RISE LAKE, WIS.—A petition has been presented to the town council for a special election to vote on the question of bonding the city to raise funds for a water-works system.

THE Board of Directors of the Turlock Irrigation District of Stanislaus County have called a special election to be held on October 8, to consider the question of issuing bonds to the amount of \$500,000, for the purpose of constructing an irrigation system. The engineer in charge of the surveys estimates the cost at \$467,544.

NEWPORT, R. I.—A special session of the City Council has been held to take action on a petition received from the summer residents, representing over \$6,500,000 worth of taxable property, for the construction of a sewerage system.

DUBUQUE, IOWA.—A special election took place on September 30, for the purpose of determining whether the people wanted a sewerage system or not. All previous votes for sewer construction have been rejected.

PANAMA.—It is reported that a company is endeavoring to obtain a charter to supply this city with water, but that the Government is unfavorably disposed to the project. The president of the company is M. Luis de Bigot.

DECATUR, ALA.—Howland & Ellis, of Boston, have the contract for the new water-works here.

GAINESVILLE, TEX.—The Gainesville Water Co. has increased its capital and will extend its service.

FAVRETTVILLE, IND.—A movement is on foot to secure the establishment of a water-works system here. Address F. R. Rose.

GAS AND ELECTRIC-LIGHTING.

ORANGE, MASS.—At a special meeting of the Town Council, held last week, it was decided to accept the proposition of the Electric Light Company for lighting the streets. The company has a capital stock of \$10,000 and will be known as the Orange Electric Light Company. The plant will be in and ready for use about December 1, 1887.

JANESVILLE, WIS., is to have an electric fire alarm system.

MADISON, WIS.—The West Superior Manufacturing Company has been incorporated; also the North La Crosse Gas-Light Co., each having a capital stock of \$50,000.

OAKLAND, ME., is to have electric-lights. A number of lights are guaranteed.

MEMPHIS, TENN.—The Equitable Gas-Light Co., recently granted the right of way through the city, has purchased twenty-five acres of land in the southern portion of the city, where they will erect their works. The price paid was \$30,000. Work will be commenced within the next thirty days.

PHILADELPHIA.—Arrangements have been completed for the purchase of the Northern Liberties Gas-Works of this city by a private corporation, the members of which are at present unknown.

MOBILE, ALA.—The Progressive Electric-Light Co. will construct a plant here.

ST. ALBANS, VT., wants electric-light.

DAYTONA, FLA., wants an electric-light plant.

OMAHA, NEB.—The subject of lighting the streets by gas or electricity has not yet been decided.

DES MOINES, IOWA.—The city's contract with the Capital City Gas Co. expires January 1, 1888, and several electric-light companies are after the business of illuminating the city. The Capital City Gas Co. proposes to light the business portion of the city with 100 arc-lights of 2,000 candle-power each for \$12 per light per month in accordance with the provisions respecting gas-light ordinances. The Thomson-Houston Company makes three separate propositions:

One hundred or more lights for five years' contract, from twilight to daylight, per light per month, every night, \$15.

Moon schedule, every night, \$11.75.

From twilight to midnight, \$9.90.

Ten years' contract, all night, \$14 per lamp per month.

Moon schedule, \$10.75. From twilight to midnight, \$9.

Fifteen years' contract, lamp to burn all night, \$13 per lamp per month.

Moon schedule (which means the lamps are not to be lighted on moonlight nights), \$10. Twilight to midnight, \$8.50.

The bids are under consideration.

YORK, NEB.—A company has been organized to put in electric-lights, the City Council having granted a franchise.

CANISTOTA, N. Y.—The Canistota Electric-Light Co. will erect a plant.

KALAMAZOO, MICH.—More electric-lights are wanted.

HAYWARDS, CAL.—There is a proposition on foot to have the town lighted by electricity.

SMELSVILLE, ILL.—The Shelbyville Water Company has added a large dynamo to its works, and will hereafter furnish the city with electric-lights.

BERKELEY, CAL.—Incorporated are the Berkeley Electric-Light Co., capital stock, \$30,000; directors are: R. P. Thomas, J. B. Henley, Daniel Dowling, Robert W. Anderson, and R. C. Dorman; the East Berkeley Electric-Light Company; the trustees for the first year are: J. L. Barker, A. Bartlett, George Schmidt, Louis Gottshall, M. H. Strelinger, C. K. Clark, A. F. Gunn, W. P. Moore, and W. C. Jones; the capital stock is \$30,000.

WEBSTER CITY, IOWA, is excited over the natural gas question. At a recent meeting \$3,000 was raised for the purpose of opening a well.

READING, PA.—The steam-heating company is at work laying its plant. A quantity of material will be wanted.

ELYRIA, O., wants a gas-lighting system.

BROOKFIELD, N. Y.—The American Electric Light Co.'s bid is \$60 per lamp annually for a five years' franchise. The trustees are not in favor of giving a franchise for five years, but offer to give a franchise for one year at a stated price and the privilege of extending it for four years more, provided the company receiving the award agree to furnish the lights as cheap as any other company.

COHOES, N. Y.—A company, to be known as the Cohoes Electric-Light Company, has contracted to illuminate this village. Five large dynamos will be placed in position in a few days, as will also two immense 100-horse-power engines. The dynamos will be operated by water power, but in case of emergency steam power will be used. The contract for the lighting of 10 electric-lamps was given to the gas-light company about three months ago, but they did not fulfill the agreement. The new company is composed of members of the gas company, and it is now thought that the city will be lighted next week.

CARROLL, IOWA, will have electric-lights.

ROCHESTER, MINN.—Work will shortly be commenced on a new gas works. A quantity of pipe is needed.

CAMDEN, N. J.—About \$60,000 worth of new gas pipe will be laid this year.

CHARLESTON, S. C.—The Charleston Electric-Light and Power Co. are making preparations to introduce the incandescent light in this city. The plant has already been purchased.

CEDAR RAPIDS, IOWA.—The Cedar Rapids Electric-Light Co. have increased their capital stock by \$75,000 and will increase their plant.

BROWNSVILLE, PA.—The American Gas Improvement Co., of Pittsburgh, will erect gas-works here.

AMERICUS, GEO.—Howland & Ellis, of Boston, Mass. have the contract for the new gas works at this place.

GADSDEN, ALA.—The Queen City Electric-Light Co. is contemplating increasing its plant.

BESSEMER, ALA.—An electric-light and power company has been organized with a capital of \$30,000. The company will erect a 150-foot tower, and are negotiating for suitable engine and boiler. Address, for further particulars, Mr. H. H. Judson, Secretary.

JAMAICA, L. I.—Bids are wanted for lighting the streets of the village. Until October 5. Address John Distler, Jamaica, or Jerome Covert, 74 South Street, New York.

BRIDGES.

CHICAGO, ILL.—The plans for the new bridge to cost \$50,000, to be erected at 106th Street, are completed, and bids are asked for.

LOS ANGELES, CAL.—A motion is on foot to build a dry dock at San Pedro. A number of San Francisco capitalists are interested in this scheme. The proposed dock is to be 1,500 feet long and the estimated cost \$300,000.

KINGSTON, N. Y.—A meeting of the joint committee from the city of Kingston and the town of Austin was held recently to consider the question of the new bridge to be built across Esopus Creek in Kingston. The following were the bids: From Wallace Brothers, \$8,136; King Bridge Company, Plan No. 2, \$5,236; King Bridge Company, Plan No. 1, \$4,500; Morse Bridge Company, \$4,975; Dean & Westbrook, \$4,600; Berlin Bridge Company, \$4,450. The contract was awarded to Dean & Westbrook for \$4,600. The committee will execute the contract at once.

TUSCALOOSA, ALA.—The contract for building a bridge for the Tuscaloosa and Northern Railroad Co., at this place, has been awarded to Messrs. Riley & Goode, of Atlanta, Geo.

LOUISVILLE, KY.—The new Beargrass Bridge will be rejected by the City Engineer. If this action is approved by the Common Council, the bridge will be torn down and re-erected.

SAN FRANCISCO, CAL.—See our proposal column in regard to a large pier to be built here.

SCITUATE, MASS.—The citizens of this place have raised a petition asking that the Old Colony Railroad Co. be compelled to build a draw-bridge over the North River. The present railroad bridge contains no draw. The company seem unwilling to construct a new bridge and offer to raise the present bridge.

ELIZABETH, PA.—\$30,000 has been subscribed for building a bridge at this place. The company has been organized under the title of the Elizabeth Bridge Co. W. M. Ekin is the Solicitor. At the next meeting officers and directors will be elected and arrangements made for procuring a charter.

FREMONT, SCHUYLKILL CO., PA.—wants bids for an iron bridge until October 10. John Healy is Commissioner.

FOND DU LAC, WIS.—Address the City Engineer for information concerning the erection of two bridges.

FREMONT, O.—A new iron bridge will be built by the L. E. & Western Railroad.

GOLIAD, TEX.—Address the City Clerk in regard to proposals for an iron bridge to be built across the San Antonio River. Bids received until October 20.

SANTA ROSA, CAL.—Address the Mayor for information concerning two new bridges to be constructed here.

WOONSOCKET, R. I.—At a special town meeting called to consider the request of fifteen taxpayers for the rescinding of the vote appropriating \$6,000 to build a bridge across Blackstone River, at Fairmount, it was decided not to rescind the vote and the bridge will accordingly be built. Address Joseph L. Brown for information.

BOSTON, MASS.—An effort will be made at the next meeting of the Common Council to pass an order authorizing the Treasurer to borrow \$250,000 for the expense of building the new bridge at Cambridge.

BUXTON STATION, MD.—It is proposed to build an iron bridge to span the railway near this place, with an average thickness of abutments of five feet. The estimated cost will be about \$8,000, the expense to be divided among the owners of the neighboring property, the county and the railway company.

ELIZABETH, PA.—The County Commissioners will build a \$50,000 bridge.

JEFFERSONVILLE, IND.—The Louisville and Jeffersonville Bridge Company will build a bridge over the Ohio River at this place.

WHEELING, W. VA.—A Union Railroad Bridge over the Ohio River is contemplated. A joint meeting, composed of the Ohio County Commissioners, Wheeling City Commissioners, and Chamber of Commerce, appointed a committee of six to treat with John A. Lynch and R. H. Cochran, of Ohio, with a view towards raising a public subscription of \$50,000 for the bridge. The United States Government has approved the plans, and given permission to erect the bridge.

ROANOKE, VA.—The Shenandoah Valley Railroad Co. contemplate renewing several small wooden bridges with iron.

FORT WAYNE, IND.—The contract for the abutments of the new bridge over the St. Mary's River at Spy Run has been awarded to Henry C. Paul. No bids for the superstructure will be received.

CHATTANOOGA, TENN.—It is expected that the contract with the city for building the bridge across the river will be signed at the next regular meeting of the Council.

TOLEDO, O.—The City Council has passed a resolution directing the City Engineer to prepare plans for an iron bridge over the Lake Shore Railroad at Sumner Street.

LOCKPORT, ILL.—See our Proposal Columns in regard to an iron bridge at this place.

CHICAGO, ILL.—An ordinance has passed the City Council providing for the erection of a double bridge at Madison Street.

BARRE, MASS.—At a town meeting held Saturday, it was voted to place an iron bridge across Ware River, near the Barre Station, on the Central Massachusetts.

SAN FRANCISCO, CAL.—The Chief Engineer of the San Francisco Bridge Co. has been instructed to prepare plans and specifications for a shed to be erected over Greenwich Street wharf.

DETROIT, MICH.—A special committee of the Town Council is considering plans and bids for the Belle Isle Bridge.

NORTHAMPTON, MASS.—E. C. Davis has been awarded the contract for building a bridge at Easthampton.

STREET WORK AND PAVING.

MILWAUKEE, WIS.—The contract for furnishing cedar blocks for paving Virginia Street has been awarded to C. A. Beck at 64 cents per square yard. Bids for laying the blocks were submitted by James Hoyer, at \$1.37 1/4; C. Murphy, at \$1.13, and John O'Connell, at \$1.27; but the contract was not awarded.

WILMINGTON, DEL.—Paving will be done on Front Street and Maryland Avenue. Address Joseph L. Carpenter, Jr., President of Directors of the Street and Sewer Department.

NEW YORK CITY.—The Dock Commissioners, September 22, sent to the Sinking Fund Commissioners plans prepared by Engineer Greene for an exterior street, 150 feet wide, under the bluff on the East River, from Sixty-fourth Street to Eighty-sixth Street; \$65,000 will be required.

STILLWATER, MINN.—City Council, September 13, appropriated \$60,000 to improvements. One of these is the paving of Main Street with cedar blocks.

NEWARK, N. J.—Street and sewer work is ordered done in Bloomfield Avenue, Norfolk Street, Oriental Street, Bergen and Magnolia Streets. Address John Hunkele, Street Commissioner.

ALBANY, N. Y.—Bids for various street-work have been opened, as below, by the Board of Contract and Apportionment. The following bids were received for paving with cobblestone West Street, from Perry to Quail:

	Paving per yd.	Curb per lin. ft.	Old curb relaid.	Crosswalk sq. yd.
Jacob Holler	\$1.05	\$0.65	\$0.35	\$0.38
A. N. Brady	1.00	.50	.16	.40

The contract was awarded to A. N. Brady. The following bids were also received for laying a 12-inch vitrified pipe drain in Yates Street, from Lexington Avenue to Robin Street:

	Vit. pipe per foot.	Y branches.	Rec'g basins.	Man-holes.
Jacob Holler	\$0.73	\$2.55	\$62.00	\$75.00
John Doyle	.90	3.00	61.10	60.00

The contract was awarded to Jacob Holler.

The following apportionments for the improvements were approved: Central Avenue pavement, between Lark and Knox, \$9,938; Columbia Street pavement, between Chapel and Eagle, \$3,974.30; Beaver Street drain, from Green to Broadway, \$687.57; Beaver Street drain, from South Pearl to Green, \$765.00; First Street sidewalk, from Lark to Knox, \$45.58; Colonic Street pavement, \$5,832.57.

CEDAR RAPIDS, IOWA.—Paving is ordered on First Avenue and other streets. Address John Gates, Acting Mayor.

SAVANNAH, GEO.—A number of streets are to be paved here.

LAKE, ILL.—\$90,000 has been voted for municipal improvements.

SARATOGA, N. Y.—The Water Commissioners will ask bids for laying a 4-inch pipe through several streets. Address Samuel F. Corey, Clerk.

JERSEY CITY, N. J.—Address Martin Finck, Clerk Board of Public Works, in regard to the improvement of various streets.

SAN JOSE, CAL.—The Common Council has adopted the report of the Street Committee recommending the improvement of various streets.

OAKLAND, CAL.—It is expected the City Council will have a special election, to vote upon the proposition to emit \$1,000,000 in bonds, the proceeds to be used for public works.

SANTA ROSA, CAL.—Among the improvements contemplated by the City Council are two new sewers, two new bridges, the grading of several streets, and the erection of a new hose-house.

NEW LOTS, L. I.—The Local Improvement Co. have decided to pave the following streets with Belgian pavement as follows: Glenwood Street, from Jamaica Avenue to the Eastern Parkway, at a cost of \$40,000; Van Siclen Avenue, from Jamaica Avenue to the Eastern Parkway, at a cost of \$40,000; and Arlington Avenue, from Fulton Street to Jamaica, at a cost of \$55,000.

ANTIGO, WIS.—\$8,000 worth of bonds have been issued to pay for town improvements.

HYDE PARK, ILL.—\$10,000 has been voted for granite block roadbed.

HARTFORD, CONN.—At the last meeting of City Council a petition was presented asking for an extra appropriation for the street department. The petition was granted and \$20,000 was appropriated for this purpose.

LOWELL, MASS.—The City Council has appropriated \$6,000 for street work.

CAMDEN, N. J.—An ordinance appropriating \$3,000 for new sewers was passed at the last session of the City Council.

For street-work in Allegheny, Pa., address James Brown, Comptroller, until October 6.

RAILROADS, CANALS, ETC.

EAST ST. LOUIS, MO.—Large railroad-frog works are to be erected here.

SEATTLE, W. T.—The Seattle Cable Road and Water Company will construct a cable road in this city within six months.

JACKSONVILLE, FLA.—A new street railway company, to be known as the Jacksonville Suburban and Real Estate and Railroad Company, has been formed in this city, with the following officers: President, Henry A. L'Engle; Secretary, C. F. Adams; Treasurer, W. A. Bisbee.

CHICAGO.—A harbor, with canal, piers, and storehouses, will be developed in East Chicago by the Calumet Canal and Improvement Company, the Chicago and Calumet Terminal Railroad Company, and the State Line and Indiana City Railway Company. Much dredging is to be done.

TOPEKA, KAN.—The City Engineer has prepared plans for a viaduct for the railways at Sixth Street.

TALLAHASSEE, FLA.—The preliminary surveys on the Thomasville, Tallahassee, and Monticello Railroad have been completed. H. S. Haines, Chief Engineer and General Manager of the Plant Investment Company, advertises for bids for the construction of that portion of the railroad from Thomasville, Geo., to the Florida State line.

MARION, IND.—The construction of the first fifty miles of the road from this place is to be begun at once. Address J. H. Cahoe for information.

WINNIPEG, MANITOBA.—The contract for the North-west Central Line has been made with Mr. J. C. Sproule, of this place. The contract calls for the completion of the line by January 1, 1888.

MILWAUKEE.—The West-Side Street Railway Co. will extend their tracks on Eleventh Street to Clybourne Street, and on Clybourne Street to Washington Avenue, a distance of about 550 feet. Washington Becker is the owner and manager.

SANTA BARBARA, CAL.—The Board of Supervisors, September 12, granted a franchise to H. L. Williams to build an electric railroad from Santa Barbara, through Montecito Valley, distance about 10 miles.

SACRAMENTO, CAL.—The Board of Trustees, September 12, granted franchises to G. W. and R. S. Carey to construct a street railway.

WOODLAND, CAL.—The City Trustees of Woodland have granted a franchise to Coward & Lawson to build a street car line. Work is to be commenced within 90 days.

SANTA ROSA, CAL.—The Santa Rosa and Carquinez Railroad Company has received right of way through the city, and work will go on at once.

SEATTLE, WASH. T.—The contract for building the second 40 miles of the Seattle, Lake Shore and Eastern Railway will be let within the next 30 days, and within the next 12 months 300 miles, extending into Eastern Washington, will be constructed.

NORFOLK, NRB.—is to have a street railroad connecting this town with Norfolk Junction.

MINNEAPOLIS, MINN.—The Minneapolis and Pacific Railroad is to build a new elevator near Shingle Creek. The cost is estimated at \$118,000.

ST. JOSEPH, MO.—The contract for building the Wyatt Park Cable Road has been awarded to J. T. Lerner, of Plainfield. The bid was for \$450,000 for 4 1/2 miles of road, and included the erection of powerhouse. Work will be begun about the middle of October, and it is expected that the road will be completed by January, 1888.

WINNIPEG, MANITOBA.—The contract to build the first 40 miles of the Port Arthur, Duluth, and Western Railroad has been awarded to Messrs. Grant & Ross. The 40 miles are to be finished by August 1, 1888.

KNOXVILLE, TENN.—The East Tennessee, Virginia, and Georgia Railway Company, will construct a road running from this city to Powell Valley. The cost of the road will be \$15,000,000. Address C. H. Hudson, General Superintendent.

SCHENECTADY, N. Y.—A new railroad is to be built by the Schenectady and Ogdensburg Railroad Co. For information address Messrs. Nye & Wiltzie, of New York.

MANITOWOC, WIS.—has asked for a franchise for a street railway.

CHATTANOOGA, TENN.—A company has been formed for the purpose of starting a horse-car road on Mission Ridge, from the tunnel to Rossville Gap, a distance of about six miles. A charter has been applied for and work will be begun at once.

SAN FRANCISCO, CAL.—A franchise has been granted to operate a street railway from California Street to Golden Gate Park, and the contracts (two in number) for its construction have been awarded.

RAILROAD.—Address McDonald, Shea & Co., Birmingham, Ala., in regard to work to be let on the Clinton and Oliver Springs Road.

OAKLAND, CAL.—A petition has been sent to the Common Council for a street railroad. Address R. Chabot for information.

SALT LAKE CITY, UTAH.—The construction of the Salt Lake City and Los Angeles Railway will be begun shortly. Address Caleb W. West for information.

RAILROADS.—The contracts for building the Pittston, Pa., and Fairview branch of the Lehigh Valley Railroad have been awarded to Smith & Ripley, of New York; Charles McFadden, of Philadelphia; John McGovern, of Towanda, and Broadhead & Hickey, of Scranton.

ST. PAUL, MINN.—The Cherokee & Dakota Railroad Company, of Dubuque, Iowa, is organized for building a railroad from Cherokee, Iowa, into Nebraska, Minnesota and Dakota. The capital stock is \$4,000,000, and the incorporators are: Edward L. Jeffery and John C. Willing of Chicago, and William J. Knight, M. Gilles, F. W. Quimby, J. Jacobs and William R. Palmer, of Dubuque, Iowa.

MONTREAL, CAN.—The contract for the Massena Springs and Fort Covington Railroad, New York State, has been awarded to Rogers & Taylor, of Montreal. This line will connect Montreal and Champlain Junction with the Rome, Watertown & Ogdensburg and other American lines, and will be constructed at once.

LINCOLN, NEB.—The Pacific Railway of Kansas has filed articles with the Secretary of State consolidating with the Pacific Railway of Nebraska. The road runs from Warwick, Kan., to Hastings, Neb., and its capital stock has been increased to \$2,600,000.

MADISON, WIS.—Incorporated is the Milwaukee Electric-Railway Company; capital stock, \$50,000, incorporators: R. Nunnemacher, Edwin A. Bartlett, John A. George, John M. Stowell, C. F. Freeman, Francis Boyd, C. E. Lewis, Cornelius I. Harwig, Henry C. Payne, Adolph Tallner, and Benjamin M. Weit. The object is the construction and operation of an electric stock railway in Milwaukee.

WINONA, KAN.—The Winona and South-western directors have closed a contract to build that road with a syndicate of Minneapolis capitalists, headed by General Nettleton. The road is to be in operation to Omaha by January 1, 1890.

NEW BRUNSWICK, N. J.—Surveyors have been at work upon a new railroad which will be built from Bound Brook to South Amboy, with stations in this city, Milton, Sayreville, and South River. The road will be a feeder for the Philadelphia and Reading Railroad, and will take the latter to tidewater in Kantan Bay. The men interested in the road are known to be H. G. Little, Congressman Kean, Miles Ross, Christopher Meyer.

PADUCAH, CHICASAW, and Birmingham Railroad has been incorporated. Principal office, Birmingham, Ala.; incorporators, James Jackson, J. B. Moore, and others.

BIRMINGHAM, ALA.—Organized is the Birmingham, Mobile, and Navy Cove Railroad Company to build a road from Birmingham to Mobile; estimated cost, \$2,500,000.

MISCELLANEOUS.

MANKATO, MINN. will issue \$15,000 bonds for new parks.

NEW YORK.—Congress will be petitioned for an appropriation of \$30,000 for the purpose of deepening the channel between Wave Crest and Jamaica Bay.

DAVENPORT, IOWA.—Messrs. Walsh & Edwards have been awarded the contract for the stone-work, and Messrs. Garstang & Valentine the contract for the brick-work for the new business house to be erected by Messrs. A. J. Smith & Son.

BOSTON, MASS.—A license has been granted to the Lewis Wharf Co. to build a sea wall and pile-wharf in Boston Harbor.

SAN FRANCISCO, CAL.—A 1,000-ton steel steamer will be built at the Union Iron-Works.

PHILADELPHIA, PA.—The Pennsylvania Iron-Works have been awarded the contract to build a steel vessel, 1,000 tons, for coast services, for the Pacific Steamship Company. Cost will be between \$175,000 and \$200,000.

AUGUSTA, GEO.—The sum of \$5,000 is to be expended for an elevator and gas and water pipe for the new Masonic Temple. Address the architect, Mr. Woodruff, Macon, Geo.

BRADFORD, PA.—The Edgar Thompson Steel Works will build a furnace costing \$300,000.

BIDS OPENED.

YOUNGSTOWN, O.—Bids were opened September 22 at 12 o'clock m. for constructing a brick sewer in Wick Street, about 1,925 feet long and 30 inches inside diameter, 6 catch-basins and 5 manholes. Other inlets supplied by cross-sewers.

King & McClure, 1,925 feet at \$2.25, total \$4,331.25; 6 catch-basins, \$180; 5 manholes, \$130; grand total, \$4,641.25.

John Megown, \$2.30, \$4,427.50, \$105, \$170; total, \$4,702.50.

Con O'Donnell, \$2.33, \$4,485.25, \$270, \$120; total, \$4,875.25.

Davis & Caldwell, \$2.95, \$5,678.75, \$150, \$200; total, \$6,028.75.

WILMINGTON, DEL.—The following contracts have been awarded by the Sewer Department: Davis & Bro. were awarded the contract for laying Belgian block on Front Street from Jackson to Justison, and on Maryland Avenue from the intersection of Front Street to Chestnut at 25 cents per square yard. John Dolan was awarded the contract for grading on Front Street from Jackson to Justison at 15 cents per yard, and Martin Keogh the grading of Maryland Avenue from the intersection of Front Street to Chestnut at 14 1/2 cents per yard.

ST. PAUL.—The contract of A. O. Noepel, Des Moines, Iowa, for steam-heating the new Court-House and City Hall, failed to be confirmed by the joint meeting of the Common Council and County Commissioners. In doubt what action will be taken.

MILWAUKEE.—Bids for furnishing the Wauwatosa Water-Works with a hose-cart, hose, etc., opened September 26, 1887:

For building hose-house, G. F. Steuwe, \$1,750; Henry Mueller, \$1,744.

For furnishing 2,000 feet 3/4 jacket-hose, and 4 play-pipes: The Gutta-Percha and Rubber Co., Chicago, \$1,475; A. H. Gardner & Co., Milwaukee, \$1,560; A. E. Foote & Co., Milwaukee, \$1,600; H. J. Delaney & Co., Milwaukee, \$1,600. A. E. Foote & Co. will furnish 1,000 feet at \$800, and H. J. Delaney & Co. the other 1,000 at same price, to whom the contracts were let.

To extend the water-pipe to the County Almshouse at Wauwatosa, September 26, 1887: Eben Badger, \$2,095.

Furnishing cedar blocks for paving Virginia Street, C. A. Beck, 64c. per square yard.

Contractor J. W. Murphy was the lowest on the new sewer for the Ninth Ward school. His bid of 72 cents per foot secured him the contract. The highest bid received was \$1 per foot.

BOSTON, MASS.—The Boston Water Board on Tuesday received proposals for building an iron roof for an engine-house at the Chestnut Hill Pumping-Station. The terms of the bids required among other things a certified check for \$100. Messrs. Cotrode & Saylor offered to do the work for \$9,861, and the Boston Bridge-Works \$6,845. The latter did not send a certified check as required, and the contract was awarded to Cotrode & Saylor.

ANNISTON, ALA.—Mr. Badders has been awarded the contract for an \$8,000 public school.

ALLENTOWN, PA.—Mr. Thomas W. Snyder, of this city, has been awarded the contract for the new silk mill at Weatherly, costing \$24,000.

DAVENPORT, IOWA.—The Davenport Steam-Heating Company have been awarded the contract for the heating-apparatus for the Masonic Temple building at a cost of \$5,000.

MILWAUKEE, WIS.—The Board of Public Works opened bids for building new school-houses in the Sixth and Fifteenth Wards and for doing the plumbing and steam-heating in both. There were thirteen bidders for the Sixth Ward building as follows: H. Schlenstead, \$42,400; A. H. Vogel, \$42,208; F. G. Horning, \$43,800; H. Schmidt, \$43,533; H. P. Muilen, \$41,700; Charles Kraatz, \$40,843; Henry Hoffmann, \$43,148; Oscar Knie, \$40,982; August Wendt, \$43,300; H. Berg, \$45,600; Henry Ferge, \$41,983; Joseph Leneschek, \$43,100; M. P. Klocksin, \$41,100. W. E. Goodman bid \$1,246 for doing the plumbing; E. T. Doyn, \$1,188, and O. H. Murphy, \$1,390. For the steam-heating apparatus, C. A. Barker wanted \$5,248; M. Coogan, \$4,700, and H. Mooers & Co., \$4,975.

For the Fifteenth Ward building, Charles Kraatz bid \$19,943, and A. H. Vogel, \$21,608. W. E. Goodman wanted \$720 for the plumbing; P. H. Murphy, \$800, and R. J. Finn, \$798. Charles A. Barker wanted \$2,895 for the steam-heating apparatus; H. Mooers & Co., \$2,970, and M. Coogan, \$2,800.

In both cases the total of the bids exceeds the appropriation and they were laid over for consideration.

ALBANY, N. Y.—The following bids for building slope-wall at Corning, N. Y., were received by the Superintendent of Public Works, September 27, 1887: Fitzpatrick & Noonan, Havana, \$8.90; McGreevy & Murray, Elmira, \$7.88; Griffin & Gorton, Corning, \$9.25. The above are the prices per lineal foot. Awarded to McGreevy & Murray.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 19. } PUBLISHED EVERY SATURDAY.

NEW YORK, OCTOBER 8, 1887.

LONDON, OCTOBER 22, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD,
conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

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ANNOUNCEMENT.

WE have decided to change the name of this journal to the title given in this issue. It is not intended to change the character of the paper. Our object is simply to convey by the first part of the name adopted the scope of the matter it regularly gives its readers.

THE UNITED STATES LIFE-SAVING SERVICE.

FROM time to time throughout the year the daily press gives an account of a shipwreck, and in most cases this account includes a more or less detailed history of the efforts of the crew of some life-saving station to rescue from the angry sea the imperilled passengers and sailors. These stories are read and soon forgotten except by the few who took part in the struggle, or possibly by some writer of romance who finds in them the best possible material for his work. But when these brief histories are brought together, as has been done for the year ending June 30, 1886, in the Annual Report of the Life-Saving Service Bureau of the Treasury Department, it forms a volume of over 500 pages, which gives one a realizing sense of the importance and extent of this branch of Government work.

The United States Life-Saving Service includes 211 stations, of which 165 are on the Atlantic coast, 38 on the Lakes, 7 on the Pacific coast, and one at the Falls of the Ohio, at Louisville, Ky. These stations had to do with 322 disasters to documented vessels during the year, involving property valued at \$6,502,135, and 2,726 lives. Of the lives 2,699 were saved and 27 lost; of the property \$5,073,078 was saved and \$1,429,057 lost.

The total expenditure for the service during the year, including salaries of officers and clerks in the central office, was a little over \$870,000. It is a large sum, but one which is extremely well invested in view of the results obtained, and we believe there is no bureau which is more carefully and economically managed or which is more deserving of public approval and support.

RAILWAY-STATION ARCHITECTURE.

SOME of the railroads in this country, notably the Boston and Albany and the Northern Pacific, have shown a praiseworthy spirit in setting the example of employing skillful architects to design the small as well as large railway-stations.

They have thus built buildings most pleasing in appearance and with much added comfort and convenience above the desolate-looking structures which add not a little to the *ennui* of travel.

The late H. H. Richardson may be said to have developed the type of American railway-station adopted by our leading architects.

By the use of the simplest constructional means, with no "constructed ornamentation," he produced buildings strikingly original and artistic in form with no sacrifice of practical considerations and with many features which, while adding much to the architectural effect of the whole, have rendered the structures more serviceable for their purpose.

The managers of the roads who have employed first-rate architectural talent in these con-

structions will have not only the satisfaction of doing the "civilized" thing, but will find, as they probably now appreciate, that there is commercial value in beauty.

SANITARY ENGINEERING AND ITS RESULTS AS ILLUSTRATED IN THE CITY OF DUBLIN.

IN the year 1879 active measures for the improvement of the sanitary condition of Dublin were commenced by the corporation. Over \$150,000 were expended in sewer construction; 4,350 water-closets have been put in place and connected with the sewers; two large, greatly overcrowded and unhealthy areas have been cleared, at a cost of about \$280,000; over \$550,000 have been expended in construction and paving of streets; an abattoir has been established, at a cost of about \$75,000; over \$50,000 has been expended in the construction of public baths and wash-houses, and over \$110,000 in domestic scavenging. Much has been done towards improving the condition of the tenement-house population, and 7,000 persons now inhabit the houses of the Dublin Artisans' Dwellings Company. In April, 1881, the population of the city proper was 249,602, numbering 54,275 families, and inhabiting 24,211 houses. At present the population of the city proper is estimated at 252,239, and of the whole registration district at 353,082.

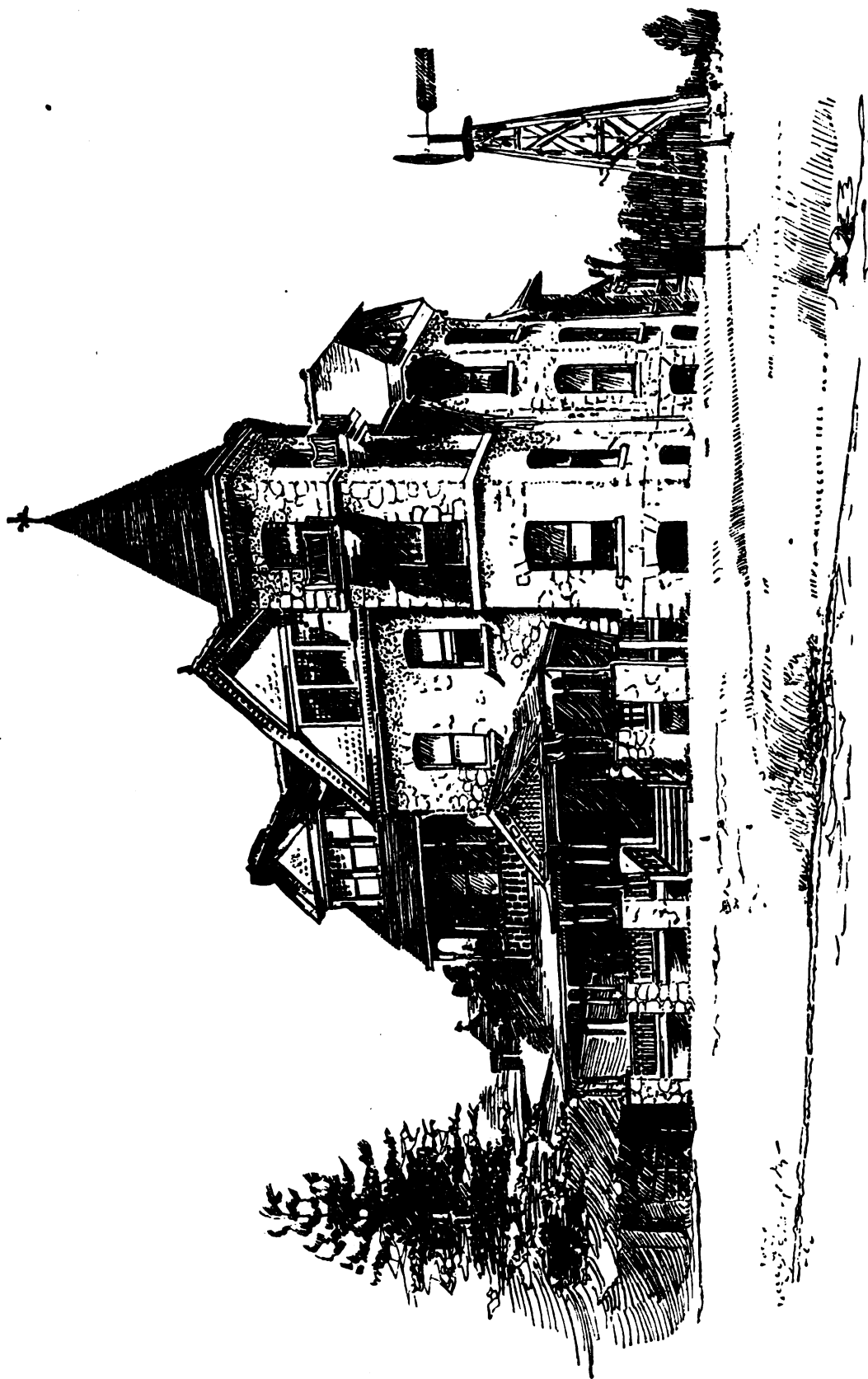
It is not yet time to perceive the full effect of the sanitary work which has been done, but some results are fairly stated in the last report of the Medical Officer of Health, Sir A. C. Cameron, for the year 1886, and to these we would invite the attention of our municipal authorities.

As Dr. Cameron remarks, the fact that there is a relatively greater number of very poor persons in Dublin than in most other large cities must be remembered in considering the death-rates. In English towns 17 per cent. of the deaths occur in workhouses and charitable institutions, while in Dublin the proportion of deaths in such institutions is 30 per cent. The death-rate for all ages was, in 1879, 35.7 per 1,000; in 1880, 35.9; and the yearly average death-rate for the ten years, 1876-85, was 29.5. In 1886 the death-rate was 26.9. One of the best tests of the results of municipal sanitary work is, as our readers know, the effect which it produces on infant mortality. In 1879 the death-rate of children under five years of age was 109.6 per 1,000, in 1880 it was 133.6, and the average for the ten years, 1876-85, was 90.2. In 1886 it was 30.8.

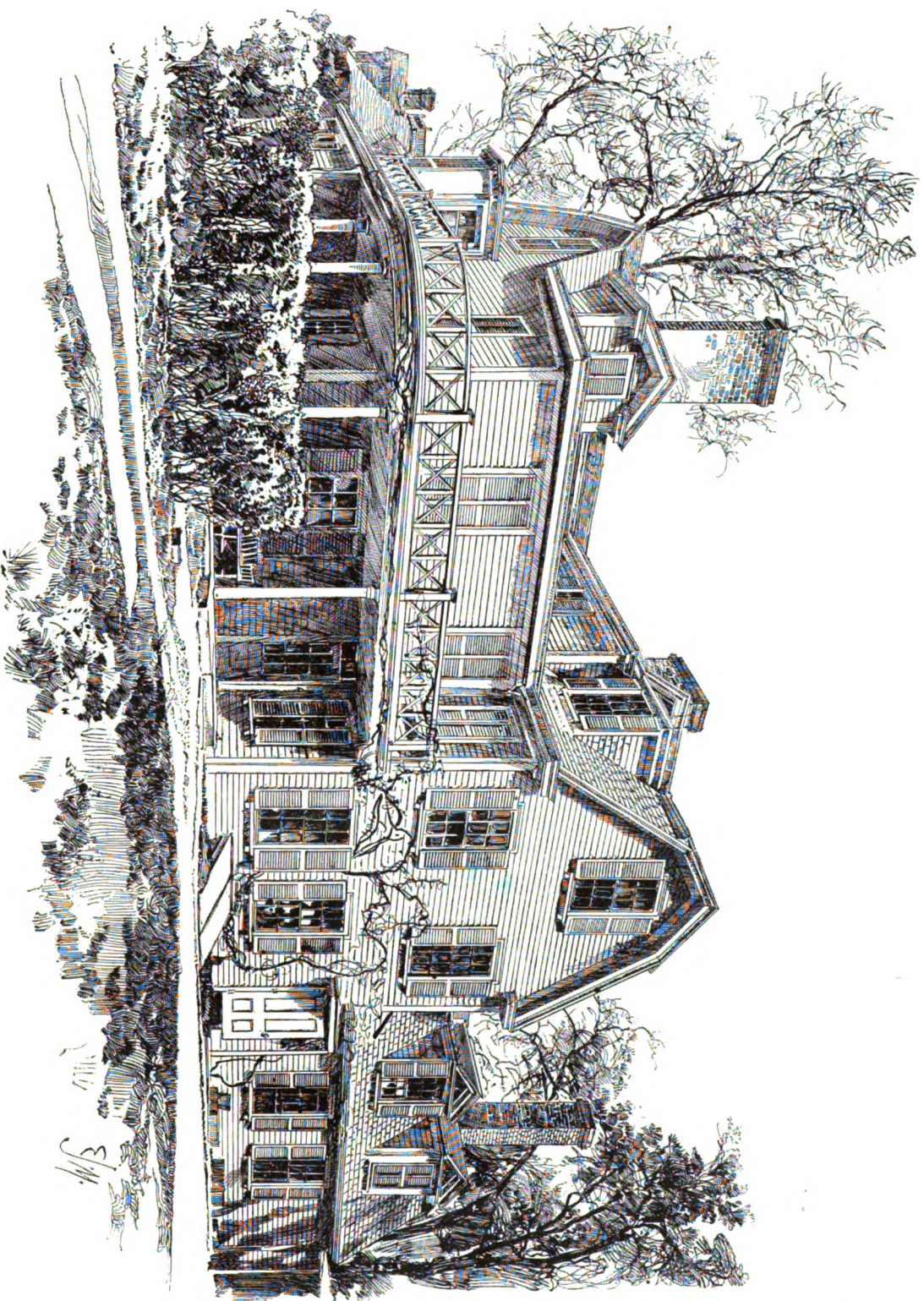
While the figures are by no means conclusive proof of increased healthfulness, since the death-rates in 1886 were low almost everywhere, they do give very good evidence of improvement when taken in connection with certain details, such as the great diminution in the annual number of deaths from typhus.

The work of improvement is going on steadily—79 houses were distenanted and closed during the year 1886 as being unfit for human habitation, 48,327 inspections of tenement-houses were made by the seventeen inspectors engaged on that work, and the estimated expenditure by the Public Health Committee is a little over \$100,000.

It is expensive work to put an old, crowded town, with polluted soil, unpaved streets, and old-fashioned, leaky sewers, into good condition, but it pays after all. We congratulate the Dublin



RESIDENCE OF S. P. STAMBACH, ESQ., HAVERFORD COLLEGE, PA.—CHARLES BALDERSTON, ARCHITECT.



THE SANITARY ENGINEER AND CONSTRUCTION RECORD ILLUSTRATED SERIES.

AN OLD COLONIAL HOUSE AT JAMAICA PLAIN, MASS.

authorities on the excellent showing that Dr. Cameron makes in his last report, and hope that five years hence they will find that the improvement in the health of the city is so distinct that there can be no doubt of the profit from their expenditure and labors.

THE "AMERICA'S" CUP AND AMERICAN VERSUS ENGLISH YACHT MODELS.

THE result of the yacht races on the 27th and 30th of last month and the general interest they excited well justify a summary of the races for this famous cup.

In 1851 some members of the New York Yacht Club sent the schooner yacht "America" to the other side as an addition to our display at the Universal Exposition of that year—and for a cup. The only race secured was at Cowes, August 22, against the entire fleet of the Royal Yacht Club. It is related that when the Queen, on being told that the "America" had beaten, inquired what yacht was next, was answered: "May it please Your Majesty, there is no next."

In 1857 the cup was given to the New York Yacht Club as a challenge cup, remaining in their undisturbed custody till 1870, when James Ashbury challenged for it with the "Cambria." Seventeen American yachts entered to defend the cup in a race sailed August 8 of that year, nine of them beating the "Cambria."

In 1871 Mr. Ashbury returned with the "Livonia" to sail the best four out of seven races with a single yacht to be selected by the New York Yacht Club the morning of the race. In October three races were sailed between the "Livonia" and "Columbia," the "Columbia" breaking its steering-gear in the third race and losing it. Two more races were sailed with the "Sappho," both in favor of the American yacht.

In 1876 the Canadians sent the "Countess of Dufferin" to be beaten August 11 and 12 by the "Madeleine," and in 1881 they returned with the "Atalanta," which was beaten November 9 and 10 by the "Mischief."

There were no further contests until 1885, when Sir Richard Sutton sent over the "Genesta." At this time many Americans were in doubt as to the relative advantages of the centre-board and deep-keel or cutter types, and some thought that a cutter should be built to defend the cup. Instead, the "Puritan" and "Priscilla" were built, both centre-board sloops, of which the "Puritan," designed by Burgess, was selected, and beat the "Genesta" September 14th and 16th.

Lieutenant Henn challenged with the "Galeata" for the races of 1886; again two centre-board sloops were built, the "Mayflower" and "Atlantic," the first by Burgess and the other by Ellsworth and a syndicate. Of course, the one man's sloop was the best and it beat the "Genesta" on September 7 and 11, to the pride of all Americans, which was mingled with a feeling of sorrow for Lieutenant Henn's defeat.

This year, as all know, the "Thistle," built by a Scotch syndicate, was badly beaten by the "Volunteer," another of Burgess' peerless boats. As the Scotch are a persistent people and Lieutenant Henn is said to intend to challenge again, while the Irish and Welsh are still to be heard from, it is probable the cup regattas will for some time give us an annual fête.

It will be noticed that in the eight contests for the cup seventeen separate races have been sailed. Of these our opponents have gained but one. In the meantime, though we have continued our lead in the matter of models, sails, and seamanship, keeping up our reputation of furnishing the best of everything for which we find a demand, the contests have been of great advantage to English yachtsmen, as their present vessels are a great improvement over those of 1851 both in model and sail plan.

At the meeting of the Association of Municipal and Sanitary Engineers held at Leicester in July, Sir Robert Rawlinson offered the sum of £10 for an essay upon the subject of sewer-

ventilation. At a recent council meeting of the association it was decided to form a committee to carry out Sir Robert Rawlinson's wishes, with power to make such inquiries and experiments as they might deem advisable. The following gentlemen have been selected as the committee: Boulnois, of Portsmouth; Clarke, of Brighton; Gordon, of Leicester; Laws, of Newcastle, and Reade, of Gloucester. These gentlemen will be glad to receive any information upon the subject which may be sent to them; and the attention of our readers is directed to the letter of Mr. Boulnois in another column.

THE ELECTRIC-LIGHT IN NEW YORK.

A RECENT number of the *City Record* gives an abstract of the proceedings of the Gas Commission of this city, whose duty it is to arrange for the lighting of the streets, public buildings, etc. The larger part of the report relates to the different bids of the electric-light companies for lighting the streets by electricity, and the final disposition of the matter.

In the first place, the form of contract has been prepared with great care. It does not contain those loosely-drawn specifications so characteristic of such documents, and which permit a company to furnish an arc-light of from 300 to 500 candles, with the assurance that it is of 2,000 candles. We are glad to see that the so-called French measurement of these lights receives no recognition whatever. The third specification of the contract relates to "luminous intensity." "Each lamp must give a light equivalent to that of not less than one thousand standard sperm candles," etc.

The photometric measurements are to be made on a Bunsen photometer, and the candle-power is to be determined at an angle of 40 degrees from the horizontal. After each observation the electric-lamp is to be revolved 90 degrees about its vertical axis and another observation taken, and so on until ten observations have been made, the average of all being taken in determining the candle-power. A gas, oil, or other lamp of at least 20 candle-power, the value of which has been determined by direct comparison with candles, is to be used as a standard light. The measurements are to be made with the globe removed. Each lamp must be operated at not less than 475 Watts in the arc. Provision is also made for the testing of the lamps; and in case the illuminating power is less than 1,000 candles, such lamps are to be paid for only in proportion to the light furnished.

If other cities would adopt a similar form of contract we should soon be rid of that most objectionable expression, "French measurement." While electric-light companies here will be obliged to give up their pet method of figuring the candle-power of their lights, especially in their dealings with the city, they will have some compensation from the fact that the candle-power is to be taken at an angle of 40 degrees instead of horizontally.

The awards made by the Gas Commission do not state the exact number of lights required, inasmuch as this can better be determined when they are in position. At the same time the following are about the number of lights awarded to each company, with the prices per lamp per night:

U. S. Illuminating Co.—About 325 lamps, at 50 cents; 38 lamps, at 40 cents; 15 lamps, at 24 cents.

Brush Electric Illuminating Co.—About 450 lamps, at 25 cents; 17 lamps, at 40 cents.

East River Electric-Light Co.—About 191 lamps, at 39 cents; 271 lamps, at 19.9 cents.

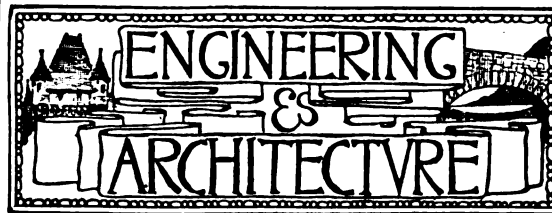
Mt. Morris Electric-Light Co.—About 15 lamps, at 40 cents.

Harlem Lighting Co.—About 116 lamps, at 24 cents; 12 lamps, at 50 cents; 7 lamps, at 60 cents.

American Electric Mfg. Co.—About 93 lamps, at 32 cents.

North New York Lighting Co.—About 26 lamps, at 40 cents.

At the August meeting of the German engineers in Leipsic, a paper was read by Engineer Busley, on "The Use of Fluid-Heating Substances for Marine Boilers." This paper is most thorough, and one that is opportune at the present time when so many are experimenting with natural oils for heating purposes. Those interested will find it in the weekly number of September 9 of the *Oesterreichen Ingenieure und Architekten Vereins*.



OUR ILLUSTRATIONS.

AN OLD COLONIAL HOUSE AT JAMAICA PLAIN, MASS.

RESIDENCE OF S. P. STAMBACH, HAVERFORD COLLEGE, PA.

HOUSE built of local graystone, rubble finish, pointed with cement. The second story contains five chambers, bath and dressing rooms. The third story has two chambers, children's play-room, large store-room and tank-room. Cemented cellar under all. All latest improvements in plumbing and sanitary arrangements. Hot-air heating, with open fires in all principal rooms of first, second, and third stories. Hardwood finish; butternut, oak, and chestnut throughout interior. Windows of main portion plate glass; electric bells, burglar alarm, and gas-lighting. The architect was Mr. Charles Balderston.

IN the course of the forthcoming International Congress on Hygiene at Vienna, from the 26th inst. to the 2d prox., papers will be read by Dr. Gartner, Professor of Hygiene at Jena University, on water tests for drinking and lavatory purposes; by Dr. Frankland, Dr. König, of Münster, and Dr. Müntz, of Paris, on purification of sewage discharge and the contamination of rivers thereby. The Waring and Shone systems of sewerage will be treated by M. Durand Claye, Engineer des Ponts and Chaussees, Paris; Major Humphrey, of Memphis; M. Clement, of Hotel Dieu, Lyons; Dr. Knauff, Professor of Hygiene, Heidelberg. M. Trelat and M. Gruber, of Vienna, will give papers on heating, lighting, and ventilation of buildings.

THE recent Manchester meeting of the British Association, Mechanical Science Section, was particularly important as regards the valuable papers read on electrical matters. Mr. W. H. Preece's paper on "Copper Wire" in reference to "Telephoning and Telegraphy" led, and was followed by a paper by Prof. G. Forbes on "Underground Conductors for Electric Lighting," who also read a paper on "An Electric Current Meter." The next paper was by Mr. Gisbart Kapp "On the condition of maximum work obtainable from a given source of Alternating Electromotive Force." Mr. C. H. W. Briggs read a paper by himself and Mr. W. H. Snell on "Alternate Current Dynamos and Transformers." The last paper for the day was by Mr. F. R. Upton on the "Tele-meter System," as invented by C. L. Clark, of New York. At the second day's session, Mr. E. W. Serrell, Jr., of New York, read a paper on "Reinforcing Electrical Contacts so as to increase their reliability." Mr. Killingworth Hedges read a paper on "A new form of 'Secondary Battery.'" Mr. F. Brew read a paper on "Underground Electrical Work in America."

It will be seen that America plays no unimportant part in the meetings of the British Association.

THE "Metropolitan Railway" is again exhaustively treated in a recent number of the *Genie Civile* by M. de N., who is an advocate of the elevated system having three principal points of train departure, or main stations, with lines circling the principal suburbs.

IN the last number of the *Chronique Industrielle* there is an interesting description of the hydraulic appliances, such as cranes, bridges, and other machinery, used on the quays of the Port of Havre. Two steam-motors are used for the compression-pumps, two accumulators, and four generators; these forming the plant which operates all.

WE learn from the *Journal of Gas-Lighting* that the French Government is about to expend a large sum in experimenting with the Duke de Feltre's scheme of using a windmill to drive a dynamo, which is to charge accumulators, and these are to supply the La Heve Lighthouse light.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XXII.

(Continued from page 433.)

THE POTOMAC FLATS DREDGING PLANT.

AMONG the dredging-machines which are arranged to transmit the material raised directly to the place of final deposit, the Von Schmidt dredge stands prominent.

lower end is a plain foot-valve of 20 inches opening, with rubber seating, so as to retain the water in the pump when not in action. The upper portion of the vertical shaft is square and slides through the bevel wheel by which it is driven.

The raising and lowering of the suction and the cutters is done by the vertical chains shown in Fig. 82 and in plan in Fig. 81. These pass to sheaves in the ends of the quadrantal arms shown in Fig. 81, and are operated by the

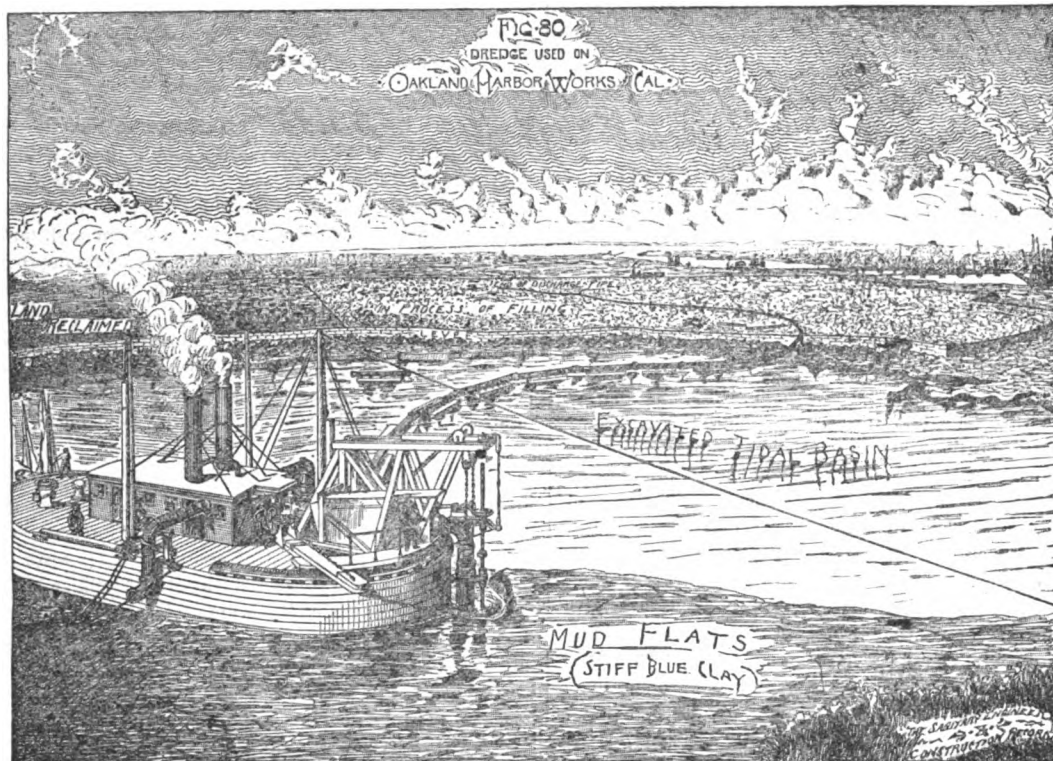
winches attached to said arms. The whole quadrant (with the supporting-frame, pipes, gears, etc.) is revolved by a gear taking into the segmental rack, as partly shown in Fig. 82. By reference to Figs. 85 and 82 it will be seen that the suction-pipe joins the upturned end of the pipe leading to the pump, by a stuffing-box within which it is free to revolve horizontally. The quadrant, etc., are attached to this part of the suction and revolve around it as a centre through an angle of about 120 degrees. This allows a circle to be dredged of about 60 feet diameter. The scow is 100x50 feet, with 7 feet depth of hold. The diameter of the hood at the bottom of the suction and also that over the pump-buckets is 8 feet. There are two boilers each 68 inches diameter, 16 feet long, with 98 tubes $3\frac{1}{2}$ inches diameter, and steam-drum 40"x6'.

Two engines run the plows and are each 12x12 inches, running at 120 revolutions per minute. With these it is claimed that at Oakland, when discharging through 4,000 feet of 20-inch pipe, the capacity of the machine in blue clay was 10 cubic yards per minute. Two engines, each 22-inch cylinder, 20-inch stroke, with 100 revolutions and 85 pounds steam-pressure, run the pump.

Three of these machines are now in use at Washington. Some larger engines are being built for driving the pumps, and Mr. A. P. Broomell presented to the Engineers' Club of Philadelphia, at a meeting in March, the following description of them:

"These engines have 24x24-inch cylinders. They are exceptionally heavy and substantial, the bed-frames alone weighing close to five tons. They will be automatic cut-offs, using my patent valves and governor.* So far as I am aware, this is the first instance of using automatic cut-off governors of the single-valve type on connected engines. Since the shafts and runners of pumps wear out very rapidly, it is necessary to make all parts of the governor in halves so that they may be readily taken off for renewal of

* This governor is not used in the machine doing the work under Col. Hains at Washington.



This type of machine was used in the harbor work at Oakland, Cal., carried out under Colonel George H. Mendell, of the U. S. Engineers, and is now in use on the Potomac Flats at Washington, in charge of Colonel Peter C. Hains, of the U. S. Engineers. The contractors and owners are Messrs. Benson & McNee, now of Washington, D. C.

The illustrations are from drawings made by us from blue prints of the machine used at Oakland, Cal.

Figure 80 shows a general view of the dredge.

Figure 81 is a plan of the front half of the boat and apparatus, and Fig. 82 an elevation of the same.

Figure 83 gives details of the frame-work, the quadrant, and the other parts for supporting and moving the cutter and suction-pipe.

Figure 84 gives details of the universal joint used in the shafting, by which power is transmitted to the cutter.

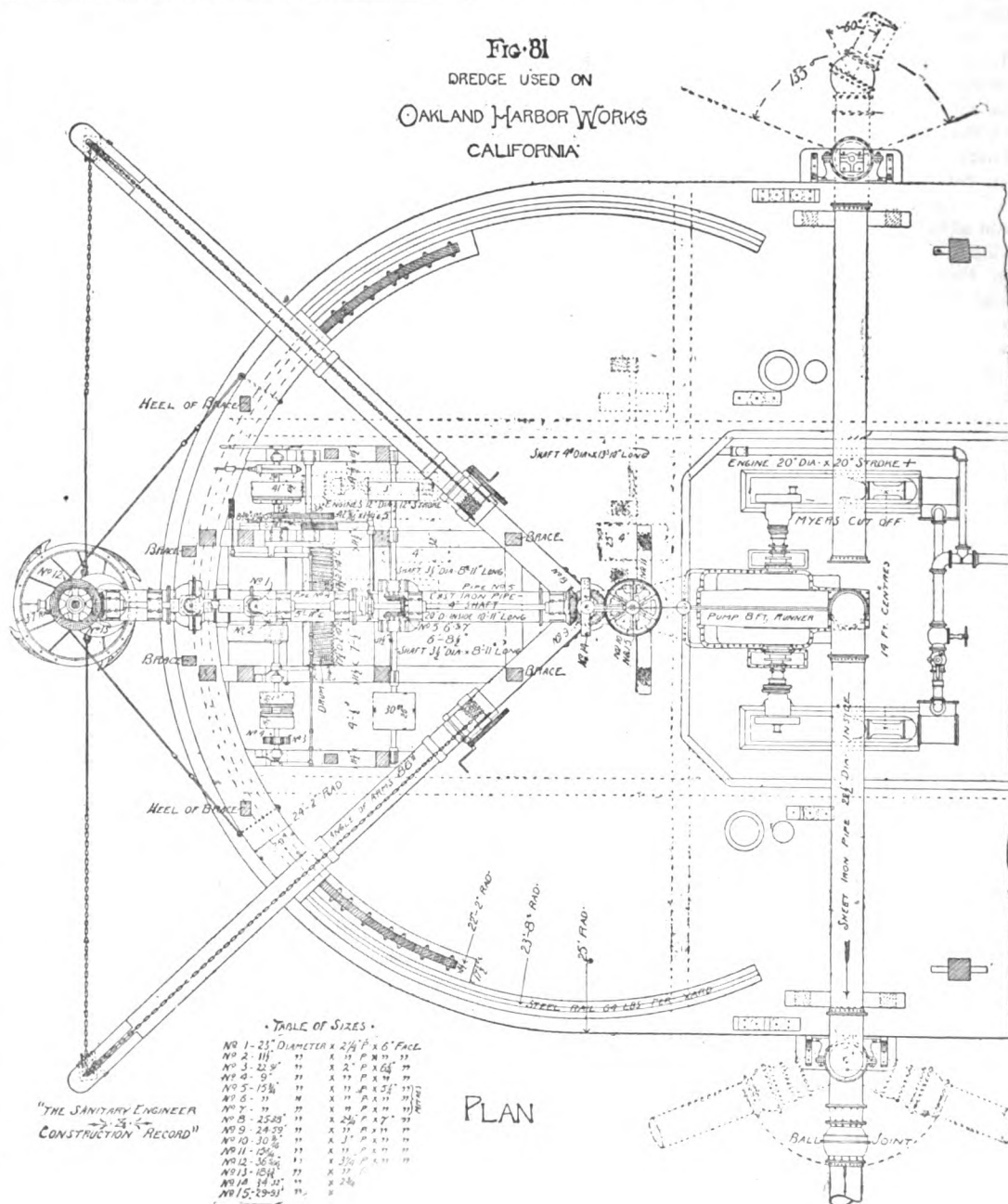
Figure 85 is the pump, etc.

Figure 86 shows the universal joints in the discharge-pipe, shown in Fig. 81, by means of which pipe the stream of water carrying the dredged material can be carried in any direction and to distances up to 4,000 feet.

Figure 87 shows the method by which the lower bend in the discharge where it leaves the boat is swiveled, so as to readily change the direction of the discharge.

The principle upon which the dredge works is to first cut up the material by a system of knives or plows attached to the bottom of a vertical rotating shaft. The plow consists of a horizontal circular iron frame or ring, attached by radial arms to the vertical shaft, to which ring heavy knives about two feet long are secured in a vertical position with the points downward. There are also four cutting knives fastened to the top of the same frame, with points upward revolving underneath the hood (to be described) for the purpose of cutting away material when from any cause the apparatus becomes too deeply engaged. The shaft passes down through the centre of a hood, surmounting the ring of cutters, and the suction-pipe has its lower end attached to the top of the hood, so that the mixed water and solid matter is drawn up by the pump and forced to its destination. Under favorable circumstances 25 to 35 per cent. is the proportion of solid matter to water; and from that down to 10 per cent, and even less. Boulders are passed up to 10 inches diameter, and of course all kinds of material of less weight.

The vertical portion of the suction-pipe is telescopic, so that work can be carried down to over 30 feet depth. At the



shafts. The requirements of this work are very severe on engines, the speed being 160 revolutions as a regular thing, and, at times, as much as 200 revolutions per minute. To prevent the engine working endwise at this high speed, it being attached only to the floor of dredges, is a pretty difficult matter. The plan I have adopted is a caging of heavy steel I-beams, firmly bolted and riveted together. We are making two pairs of these engines, as well as five smaller ones for these parties. A few of the leading sizes are:

"Crank shaft, of hammered steel, 13 feet long, 11 inches diameter. Main bearings, 17 inches long, babbet-lined. Crank pins, 6x6-inch, hammered steel. Piston-rods, cast steel, $3\frac{3}{4}$ inches diameter. Piston-heads have self-packing rings of cast iron. Steam-pipes, 6 inches diameter.

From a paper by Mr. Conway B. Hunt, read before the Engineers' Club of Philadelphia (see Proceedings, Volume VI., No. 2), we take the following additional items:

"The pump is a centrifugal one, of special design. The main chamber, in which the wings revolve in a vertical

plane, is eight feet in diameter and twenty-two inches in width. Its lower half is jacketed by an outer chamber through which the material is taken from the suction-pipe at the rim, and admitted to the pump at the centre through openings in the sides of the main chamber. The shaft to which the wings are attached is surrounded by a water-packing at its entrance to the pump-chamber, to prevent any leaking of air at these bearings and consequent impairment of the vacuum. The wings are six in number, and their radial direction is deflected away from the direction of their revolution. The pump is geared directly to the engine, which is double, with cylinders twenty-two inches in diameter and 24-inch stroke. They are run at 130 revolutions per minute, with a steam-pressure of 90 pounds at the boiler and cut off at one-half stroke, and their effective horse-power is rated at 200. The discharge-pipe leads off at a tangent from the main chamber of the pumps, and, after leaving the dredge, is carried to the shore on pontoons and thence to the point of discharge along the surface of the ground. It is of sheet-iron, twenty inches in diameter, and made in 32-foot and 16 foot lengths, the longer being used on the portion resting on pontoons, and the shorter ones on the shore section. The joint connections of the discharge-pipe are of rubber hose, two and one-half feet long and slightly larger than the pipes, over the ends of which they fit tightly and are secured by iron straps.

"The general operation of dredging is briefly as follows: The machine being secured in position by spuds, the suction-pipe is lowered to the bottom to be dredged, and the plows and pump are started, the latter being first "primed." The table is then swung slowly around the bow of the boat, the plows cutting a 9-foot swathe, two feet deep, and the shape of a semi-circle 60 feet in diameter, all the spoils being carried away through the suction as fast as dredged. By shifting the position of the dredge or lowering the suction-pipe, any desired size and depth of cut is obtained. The operator is guided in his management of the excavating apparatus by a vacuum gauge attached to the suction-pipe, which serves as an index of the proportion of mud or other material which is entering the suction. As the plow becomes too deeply engaged, this gauge marks a more perfect vacuum, and the reverse indicates a contrary condition. The consequence of admitting too large a proportion of solid matter to the suction is the clogging of the discharge pipe by the deposit of the surplus in its depressions and joints. The percentage of solid matter, which it is found best to admit to the suction, varies greatly according to the nature of the material. In dredging mud as high as 40 per cent. has been averaged, while in sand the percentage is much less. The efficiency of the dredge in hard material is noticeable, but it is not an economical machine for this class of work, on account of the large amount of water that must be moved in order to carry the material through the pipes."

"It may be noted, in conclusion, that the general requirements of a successful hydraulic dredge would seem to be, first, such a plow system as will excavate and thoroughly mix with water the material to be dredged and deliver it uniformly to the suction; second, a properly designed pump of sufficient power, presumably centrifugal, that will freely pass anything that can enter the suction, driven by an engine fully capable of developing the pump's best duty; and third, a general system of suction and discharge pipe which shall develop the least practicable frictional resistance, especially that due to bends. The numerous devices and details by which these requirements are attainable are, and necessarily will be, the subjects of various patents, and, as a consequence, their most efficient combination may be long deferred. The large number of machines that are still in the experimental stage of development would indicate that the best results attainable from hydraulic dredging machines have not as yet been accomplished."

In reference to the work done at Oakland, Mr. L. J. Le Conte, the assistant engineer in charge, states that the discharge was under a head of 14 feet above mean tide-level. The average discharge per month was 41,500 cubic yards of material, working 10 hours per day. The work for the last two months was 65,000 per month.

From a report by Colonel Hains on the Washington work, No. 1 dredge has discharged from 39,000 to 68,000 per month through 900 feet of discharge-pipe, and No. 2 has thrown as high as 90,000 yards through 1,200 feet of pipe. The longest pipe used up to date (September 22, 1887) was 3,500 feet.

(TO BE CONTINUED.)

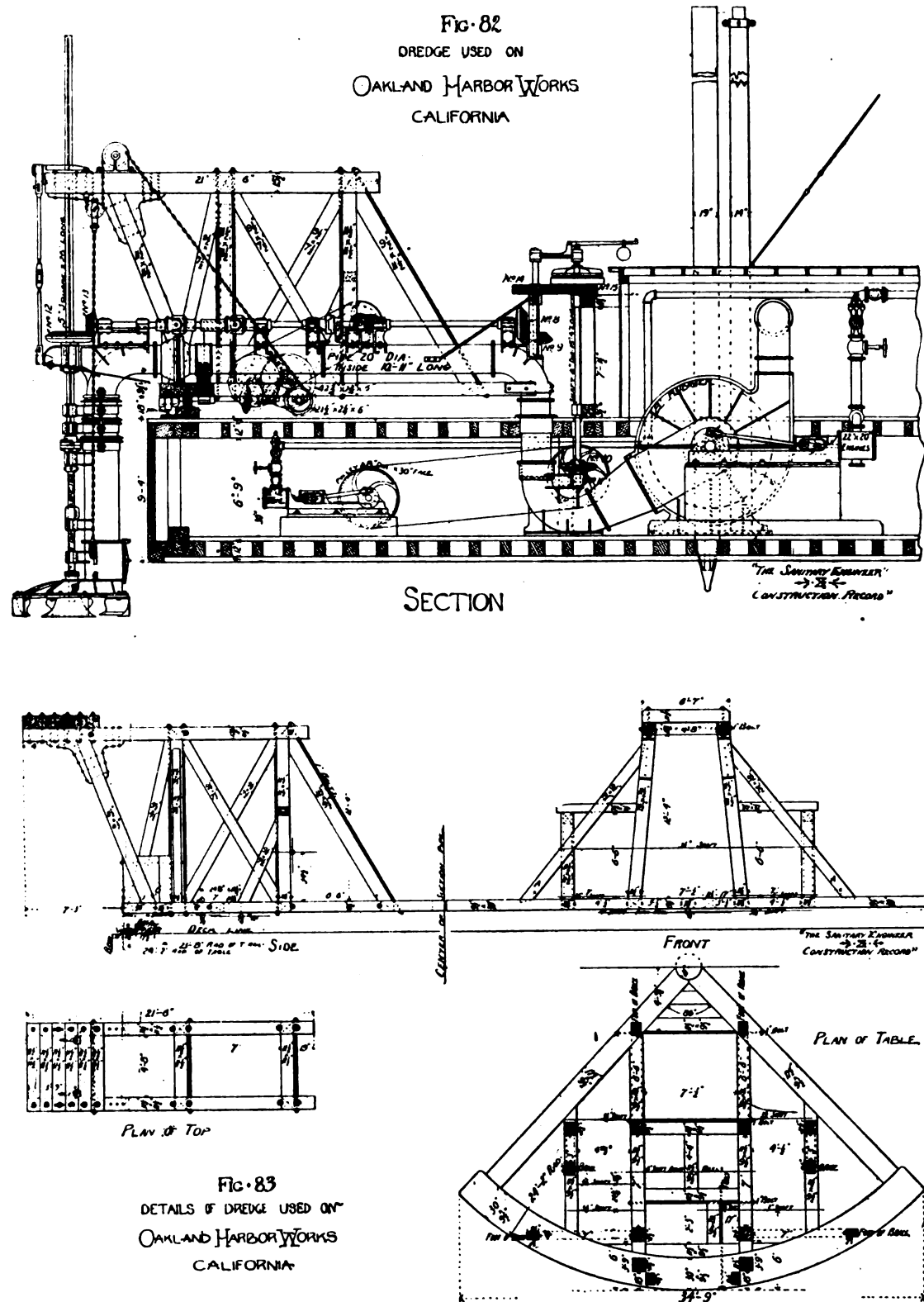


FIG. 83
DETAILS OF DREDGE USED ON
OAKLAND HARBOR WORKS
CALIFORNIA

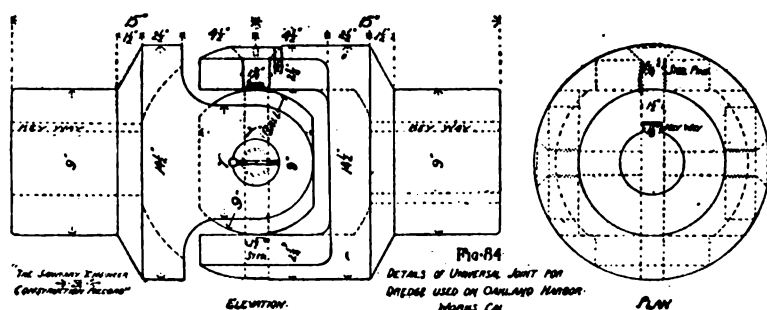
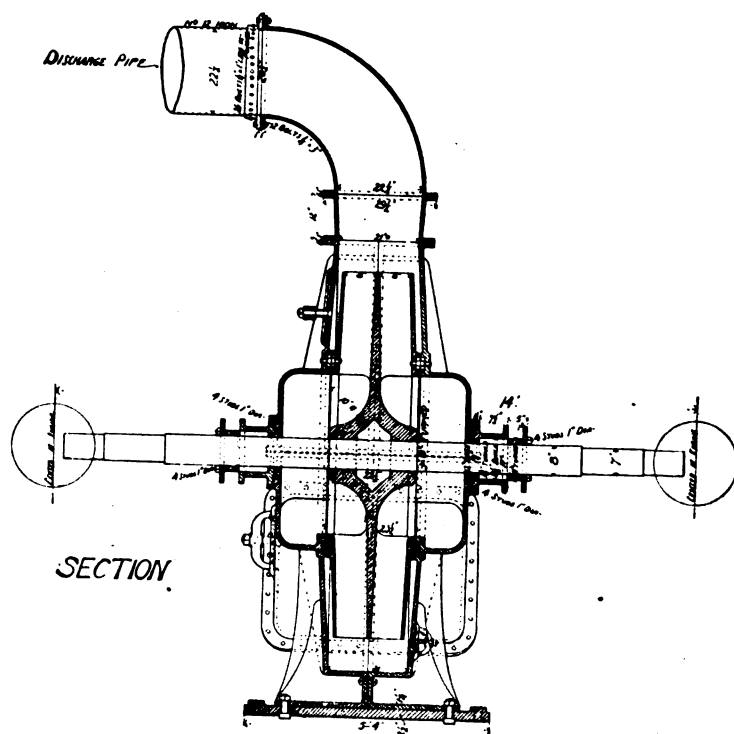
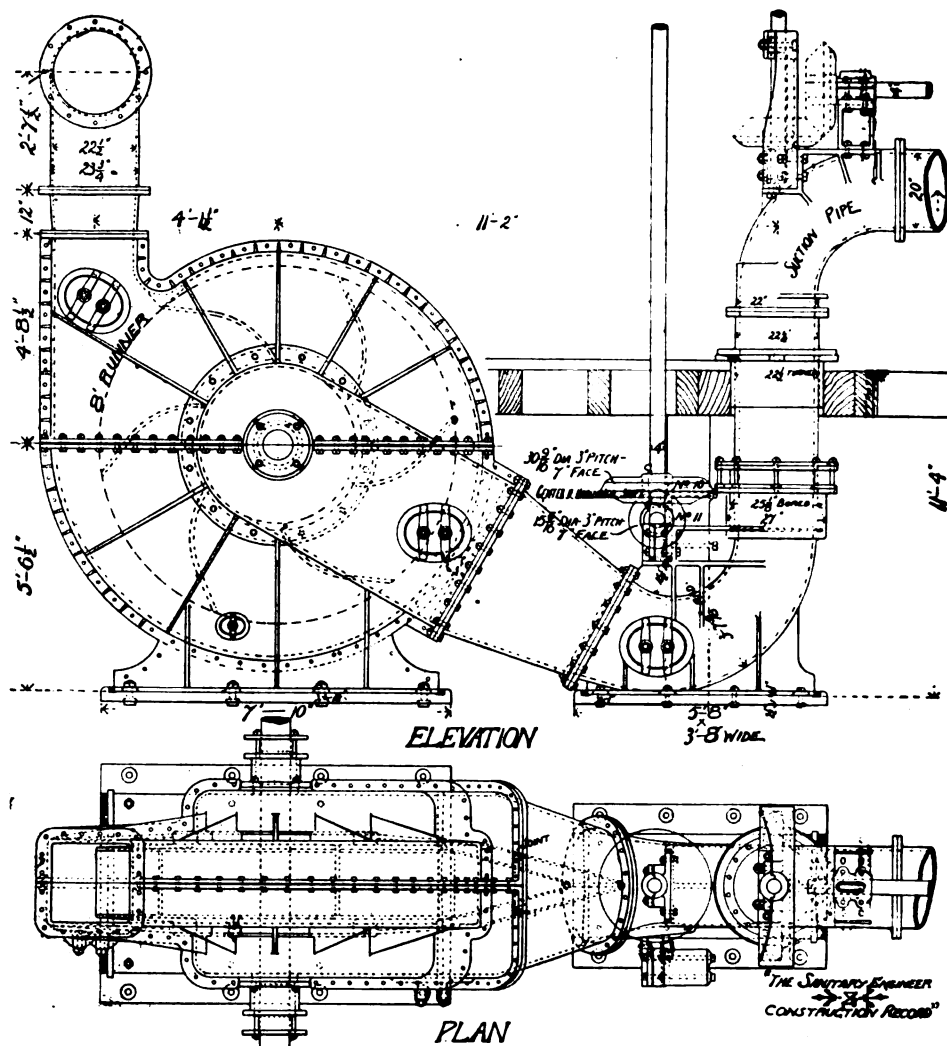
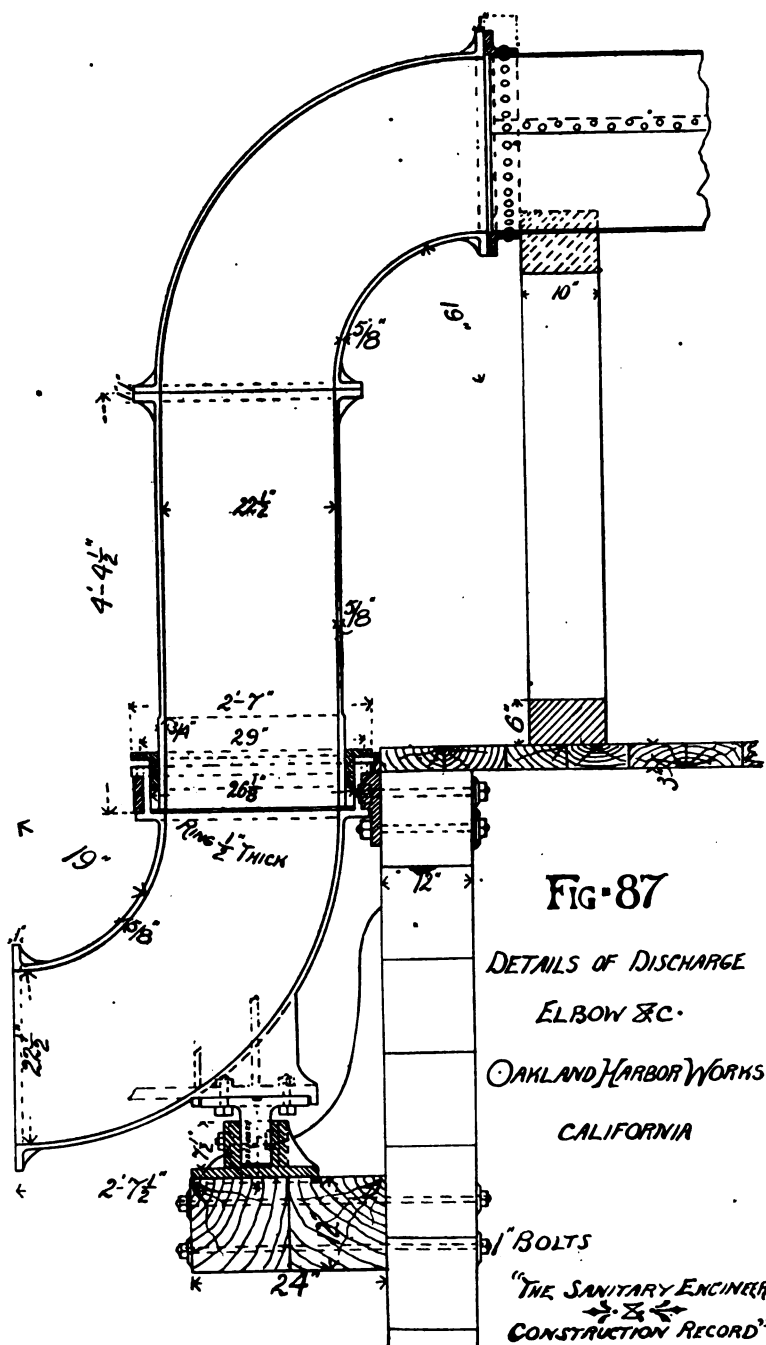
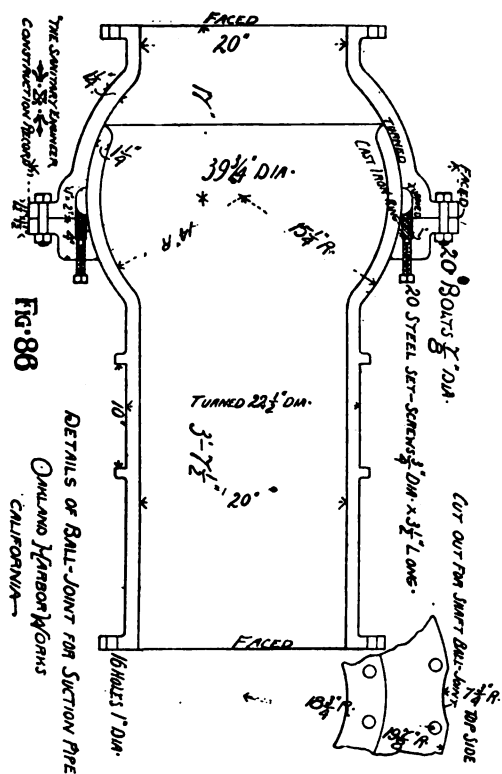


FIG. 84
DETAILS OF UNIVERSAL JOINT FOR
DREDGE USED ON OAKLAND HARBOR
WORKS, CAL.



RECENT WATER-WORKS CONSTRUCTION.

No. XIV.*

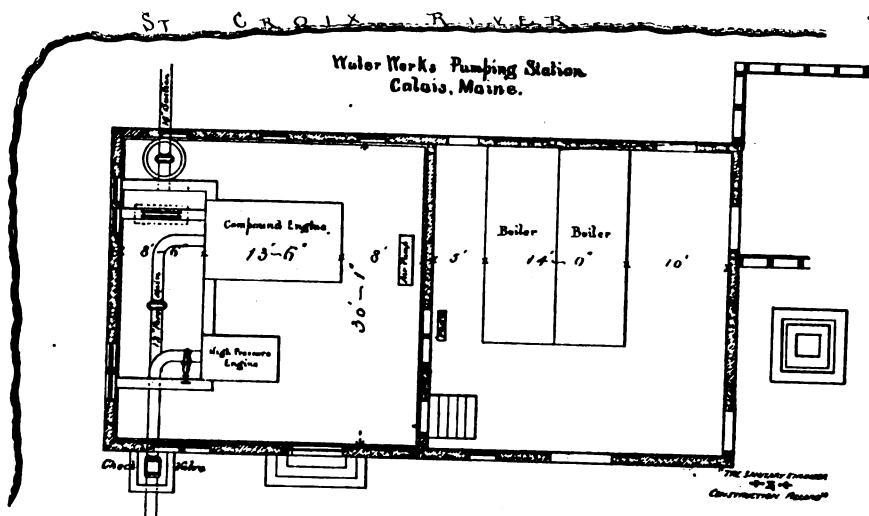
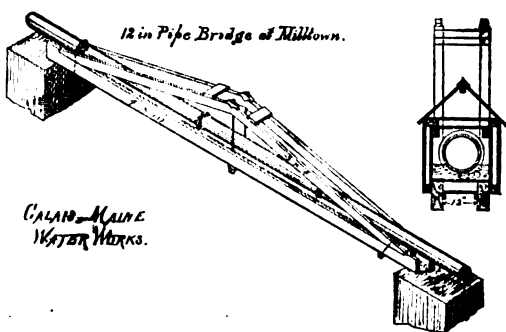
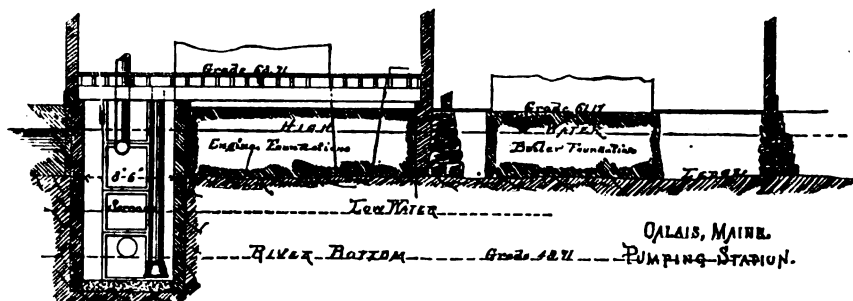
CALAIS, MAINE.

THIS, the most easterly city in the United States, is situated in Washington County, on the south bank of the St. Croix River, which is at that point the boundary line between this country and the provinces.

The city lies about eighty miles north-east from Bangor, is at the head of river navigation, has a population of over 6,000, and does a large business in lumber and ship-building, producing a million superficial feet of lumber per day, and building ten to fifteen vessels each year. A large fire in August, 1870, which burned over forty acres and consumed fifteen wharves and twenty vessels, together with other less disastrous conflagrations of later date, pre-

million gallons capacity (cost about \$10,000), with six miles of 4 to 12 inch pipe, 50 hydrants, and 90 gates in St. Stephens and Milltown, all owned by the St. Croix Electric-Light and Water Company.

The supply may be drawn directly from the river, or through a filtering-crib made of logs, built up log-cabin fashion 10 feet square by 12 feet in height, enclosing a circular open-jointed brick wall of 3 feet inside diameter, the space between the logs and well being filled with broken stone and gravel. Water-power, though abundant in the neighborhood, was not available for pumping, and two horizontal boilers, 66 inches diameter and 16 feet long, furnish power for two pumping-engines made by the George F. Blake Manufacturing Company, of Boston. The main engine is a compound duplex 14x28x14x18, of



pared the way for a public water-supply, which was introduced during the season of 1886 under the joint control of the Calais Water Company and the St. Croix Electric-Light and Water Company.

M. M. Tidd, Mem. Am. Soc. C. E., of Boston, was the consulting engineer, and the plans and specifications prepared under his direction included, on the American side of the river, the pumping-station, which is located on the river bank two miles above Calais, 14,484 feet of 12-inch pipe, 1,437 feet of 10-inch, 3,812 feet of 8-inch, and about 30,000 feet of 6-inch pipe, with 80 hydrants and 70 gates, and this portion of the double works is owned by the Calais Water Company. That portion of the works on the English side includes a reservoir of two

1½ millions capacity, and the reserve a high-pressure 1-million duplex 14x10x12.

The pumps force the water through a 12-inch pipe across a bridge at Milltown into the reservoir located on Todd's Mountain, in New Brunswick, at an elevation of 225 feet above high tide. The reservoir is rectangular in form, of earth, with clay-puddle walls, and in size is 184x151 feet inside at top and 133x100 feet on bottom.

The pipe on the American side was from the Warren Foundry, of New York; that used on the English side was cast at Glasgow, Scotland. All hydrants and gates were from the Chapman Valve Manufacturing Company, and J. J. Newman, of Providence, R. I., was the contractor for the entire work. The Calais works cost about \$78,000, and those of the St. Croix Company about \$30,000. Webster Lewis and Josiah S. were the company in both cases.

* No. XIII., the Water Works of Ware, Mass., was published on page 179, issue of July 16.

PAVEMENTS AND STREET RAILROADS.

No. XVII.

(Continued from page 490.)

WOOD PAVEMENT IN THE METROPOLIS.*

THE DISCUSSION.

IN the early part of 1882, when the pavement had been down less than five years, it became evident that its life had gone, and that it would have to be taken up. It had been his duty to take up the portion in Holborn in sections, in the years 1882-3; and not one block laid in 1877 was now to be found there. He might also mention, lest it should be thought that the circumstance had arisen from some want of care on the part of the officials of the Holborn District, that the portion laid down in the St. Giles's district as far as Tottenham Court Road had also been removed and relaid with Val de Travers asphalt. The wood pavement in Hatton Garden, which was considered a very suitable thoroughfare for the purpose, was laid in the Michaelmas quarter of 1878. It contained 4,679 yards superficial, and cost £3,743, or 15s. 6d. per square yard. It was laid in 1878, and yesterday, May 27, 1884, the Val de Travers Asphalt Company proceeded to take it up, and they were now laying down asphalt in its stead. With those facts before them he asked the members of the Institution to pause before they too readily endorsed the propositions of the author with reference to the economy of wood pavement.

Mr. W. E. Rich said, he thought the question asked by the President with reference to traction was most important. He believed that wood pavement was extremely favorable in regard to its low resistance to traction, and that was an important element which should encourage its extensive adoption. He hoped that some information would be forthcoming on the subject, obtained by means of the new dynamometer belonging to the Metropolitan Board of Works. He had himself had two hours' run with it a few months ago in some preliminary trials, and he had been surprised at the immense reduction in traction on going from a macadamized road to a wood pavement. He believed that the traction over a wood pavement did not exceed one half of that over a macadamized road, and it much less than that over a stone pavement.

Mr. E. Matheson inquired why the author had omitted all reference to asphalt. The paper seemed to imply that wood was the only alternative to macadam. Mr. William Haywood had exhausted the subject a few years ago, but he thought that later experience might induce him slightly to modify his views. In many respects asphalt was better than wood. The question of cost was not the only one to be considered. In regard to traction he had no doubt that asphalt was much superior to wood; but its alleged slipperiness had at first condemned it, and hindered its adoption. He believed it had been found that the difficulties connected with slipperiness had arisen from the inexperience of the drivers, and the strangeness of the new pavement to the horses. In Holborn, in the St. Giles's District, the wood pavement was about to be replaced with asphalt; and Cheapside also had an asphalt pavement. The low cost of cleaning, and the little delay in laying (an asphalt road being ready for use in twelve hours, while the author of the paper stated that wood pavement required a week), were important points in favor of asphalt over wood.

Mr. Hugh McIntosh said that he had not had sufficient experience to give a decided opinion upon the question in dispute. In his districts the authorities were only just beginning the use of wood. There were certainly some disadvantages connected with asphalt, with which he had made himself acquainted by observation and inquiry, and from which wood pavement was entirely free. The little experience he had had inclined him to favor wood in preference to asphalt.

Mr. J. Lovegrove remarked that only a very small area of wood pavement had been laid in his district. It was put down two years ago by the Improved Wood Pavement Co., and it had proved a successful piece of work. There were two rails passing through the centre of its width, and blocks of Guernsey granite, well dressed, were placed on each side of the rails. That was a very successful way of dealing with the difficulty of obtaining a comparatively noiseless pavement opposite a public building. They had had Val de Travers asphalt at first, but the rails and the asphalt did not wear well together. Some years ago he had made some experiments with a view of testing the cost of the maintenance of macadamized roads, and the result was that he advised his board that when the cost was found to reach 2s. per square yard, it was time to get rid of macadam and lay down wood or stone paving. There was a good deal of saving with wood and stone pavement in the matter of cartage, by far less mud being made than on macadamized roads. It was very important that all the information obtainable with reference to asphalt paving, pitching, and wood, should be laid before the members, and their thanks were therefore due to the author for his efforts in that direction.

Mr. A. Giles, M. P., considered that the author had not done justice to the subject of creosote in his statement when he said that creosote to a certain extent closed the fibres of the wood, and tended to produce premature internal decay. Mr. Giles had had great experience in creosoting, and this was the first time that he had ever heard of creosote tending to promote premature decay. It was quite true that the pickling process was worse than useless, but if the blocks, before being laid, were properly creosoted they

* A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.
† Minutes of Proceedings Inst. C. E., vol. lviii., p. 6r.

would last much longer than they did at present. It appeared from the statistics in the paper that the actual wear was only 0.144, or $\frac{1}{7}$ inch per annum. The average duration of wood pavement was six or seven years, and as the blocks were 6 inches deep, they only lost about one-sixth of their depth in the whole period of their life. The destruction of wood pavement was caused, not so much by wear as by decay, for every one must have noticed that when wood pavement was being taken up, a great deal of it was as rotten as touchwood. That would not occur if the wood were properly creosoted before being laid. He was sorry the author had not gone back to the early days of wood pavement in 1842, of which Mr. Giles had a lively recollection. It was nonsense to say that the slipperiness of wood pavement was only felt by inexperienced drivers, for there were certain states of the atmosphere when the pavement became so moist and greasy as to render it absolutely unsafe for horses. If something could be devised to prevent that slipperiness, a great benefit would be conferred upon the traveling public.

Mr. S. B. Boulton said that he had had considerable experience in creosoting, but not much in the application of that process to wood pavement. It would appear that usually the paving blocks were merely dipped in creosote, and perhaps sometimes in a mixture of that and other more doubtful substances. Was this a wise course to pursue? It was well known how much the creosoting process had been improved by the abandonment, for ordinary engineering purposes, many years ago, of the mere steeping tank, in favor of the cylinder process by vacuum and pressure. In one instance referred to by the author, that of the King's Road, the blocks appeared to have been prepared by the latter process. In this case only seven pounds of creosote per cubic foot had been injected. The "resources of civilization were not exhausted," however, by the injection of so small a quantity. The author had said that these blocks were, when taken up, moist internally, although it did not appear that they were unsound. The internal moisture could only have resulted from one of two causes, either that the wood was not dry enough at the time of creosoting, or that the quantity of creosote employed was insufficient to prevent the subsequent infiltration of water. Many engineers caused to be injected for railway sleepers and other timber, 10 pounds and 12 pounds of creosote per cubic foot. Even with these quantities the injection was partially superficial, but the creosote completely saturated the sap wood and softer parts of the timber, filling up all cracks and fissures, whilst the ends of the logs, for some inches up, were usually gorged with the creosote. Small pieces of timber like paving blocks should if prepared be saturated with creosote like the extremities of a sleeper. When timber was unprepared the ends of a log absorbed moisture freely; and this must be the case more especially with paving blocks. Moreover, it was not pure water to which the paving block was exposed. Ammoniacal products, the very class of substances which were used in experimental putrifying pits for hastening the decay of timber, were largely present in the moisture of the London streets. It spoke well for the paving blocks, and for the selection of the wood of which they had been made, that, unprepared or slightly prepared as they were, they had lasted as well as they had done. He was surprised to hear the author of the paper express the opinion that creosoting, by closing the fibres of the wood, tended to produce premature internal decay. General experience in this and other countries during the last forty-five years was entirely to the contrary. There had recently been exhibited at the institution a large collection of specimens of creosoted wood, sent by various railway administrations and from other sources, and which had been placed in many different kinds of soils. These specimens of ordinary creosoted fir timber had remained sound for periods varying from 10 to 32 years, and showed conclusively that the creosote, which had filled up the outer portion of the fibres, had completely protected the inner portion of the wood from decay. To produce such results it was of course necessary that the wood should be deprived of moisture, and that the creosote should be of a suitable kind. The wearing away of the top surface of the blocks appeared to be rapid; any decay of the woody fibre would doubtless accelerate this abrasion. Creosote had not only a preservative, but also a hardening effect upon timber, and if thoroughly injected could scarcely fail to prolong the duration of paving blocks. As regarded the kind of timber to be used, he thought that a greater variety might be tried. Gothenburgh had been spoken of, and excellent timber could be procured from that port, but no better than from various other Swedish ports, or from Memel, Danzig, or Riga. Beech he thought would do good service; it absorbed creosote remarkably well, and evidence had recently been brought forward of the very long duration of creosoted beech sleepers on the Chemins de Fer de l'Ouest in France. English elm also absorbed creosote readily, which was not the case with the American rock elm. He had recently taken three pieces of ordinary fir sleeper wood, three of English elm, and three of American elm, and had subjected them to the creosoting process under nine hours' pressure. The pieces of timber were all cut to the size of ordinary paving blocks, 6 inches by 6 inches by 3 inches. The results were:

AVERAGE QUANTITY OF CREOSOTE ABSORBED PER CUBIC FOOT.

	Lbs. oz.
Three pieces of fir.....	27 1
" " English elm.....	27 13
" " American elm.....	4 10

In forests through which he had traveled in Canada, the United States, Russia and elsewhere, he had noticed a great waste of timber in cutting the lengths for the ordinary purposes of the market. If some uniform standard of size for paving blocks were adopted in this country, and if it became known that there was a constant demand, much of this waste timber might be utilized by being cut into blocks, either in the forest or at the shipping port, whilst they could be brought here as convenient stowage for vessels at a very low rate of freight. He could remember some years ago when his offices were in King William Street, near London Bridge, the effect produced by taking up the granite pavement and substituting wood. No words can describe the sense of relief in the mitigation of the roar of a mighty traffic, which was at once experienced by all the busy toilers whose work had to be carried on amidst such surroundings.

(TO BE CONTINUED.)

SEWERAGE IN AUGUSTA.

THE report of the Board of Health of Augusta, Geo., for the year 1886 gives details of the work of sewer construction and repair which is going on in that city under the direction of the board, from which it is evident that a vigorous effort is being made to secure good and permanent work.

The President of the Board, Dr. Eugene Foster, calls attention to the fact that "every sewer and drain built by the board is part of a definite fixed plan and will not have to be rebuilt, as has been the case with fully eight-tenths of those built under the hap-hazard system of sewer building prior to the adoption of a complete plan for the entire city." Thus far none of the sewers built by the board have become clogged or have required manual cleansing.

The chief work during the year seems to have been the rebuilding and extension of the Macintosh Street sewer, amounting to 4,750 feet. The defects of grades, shapes, and depths of the old sewer are stated to have been such as to make it a curiosity, as well as a source of danger to the public health. Three thousand five hundred and eight feet of pipe-sewers were laid at a total cost of \$1,217.96, or a little less than 35 cents per foot. The reconstruction of the Macintosh Street sewer cost \$6,732.02. There is still plenty of work of the same kind to be done, for Dr. Foster remarks that of the 354 squares in Augusta, 250 have no contiguous sewer of any kind, and there are 5,689 surface privies in the city. The principal epidemic during the year was one of measles, of which it is estimated that there were nearly 3,000 cases. The estimated population is 36,000; whites, 20,500; colored, 15,500; and on this basis the death rate was, per 1,000: white, 16.48; colored, 33.86; total, 23.97.

FIRST REPORT OF THE OHIO STATE BOARD OF HEALTH.

THE State Board of Health of Ohio has issued its first report, which is for the year ending October 31, 1886, and thus begins another series of sanitary documents which it is to be hoped will be a long and important one. This first report is necessarily largely of an educational character, being intended to show the people what kind of work a State Board of Health might do, and what action is yet required on the part of the State to make it possible to do such work. The President of the Board, Dr. W. H. Cretcher, and the Secretary, Dr. C. O. Probst, both see very clearly that State sanitation to be effective must have a satisfactory system of registration of vital statistics, and it is plainly shown that at present the State of Ohio does not possess such a system.

It is truly stated that "it is of the first importance that a law be enacted requiring a burial permit for the interment of every dead body within the State. The permit should be obtained only from an authorized person, who, before granting the same, should demand and record all the facts required in connection with the death." There is no other way of obtaining the information which a State Board of Health must have if it is to do effective work. In his address the President lays stress on the inefficiency of voluntary aid in State sanitary work and urges legislation requiring every chartered village, town, and city within the State to maintain a local board of health. In this he is in accord with the experience of other State boards, which have found that among their most important duties are those connected with the local boards.

Dr. Cretcher also advises the appointment of a salaried health officer for every county in the State, an experiment which has not yet been tried, and which will probably not be tried unless the results of local board work are decidedly unsatisfactory.

The appendix to the report of the board contains accounts of some local investigations into sewerage, water-supply, pollution of streams, an epidemic of diphtheria, etc., all of which show the need for both local and central sanitary authority; and some educational essays on food adulteration, heating and ventilation, school hygiene, etc., which, it is to be hoped, will be read with profit.

The report by Dr. H. J. Sharp on the water-supply and sewerage of Bellaire shows that the inhabitants of that city have for some time been drinking diluted sewage, and it appears that there is a disease known as "Bellaire fever," which is probably a mild form of typhoid, and which would be one of the results to be expected, sooner or later, under such circumstances.

The volume also contains, as a supplement, the proceedings, addresses, and discussions at the State Sanitary Convention held at Warren, O., in March last, which was well calculated to arouse and educate public opinion as to the importance of sanitation.

INVESTIGATING WATER-SUPPLIES.

THE New England Water-Works Association has issued the following circular to its members:

NEW ENGLAND WATER-WORKS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., September 21, 1887.

To the Members of the New England Water-Works Association.

GENTLEMEN: In the accompanying letter from Dr. Leeds a valuable opportunity is offered—viz.: to render such aid as may be possible in the study of the origin of tastes and odors affecting public water-supplies. Many of us possess information upon this point, and we should not forget that the smallest details may prove valuable. It is the desire of Dr. Leeds to obtain all possible assistance in this interesting and important research, and an earnest request is hereby extended that you will give that assistance by communicating to him every fact relating to the subject of which you may have knowledge. Yours truly,
R. C. P. COGGESHALL, Secretary.

STEVENS INSTITUTE OF TECHNOLOGY,
HOBOKEN, N. J., September 20, 1887.

R. C. P. Coggeshall, C. E., Secretary N. E. Water-Works Association.

DEAR SIR: At the Manchester meeting I was encouraged to believe that the members of the association would give such aid as lay in their power, in a study of the origin of the tastes and odors affecting most water-supplies. I have already collected considerable data, the information having been classified under the heads given below. Will you not request our members, at an early date, to send me similar data relating to their special work. In case the nature of the growth, etc., affecting the water is unknown to them, and they will express me a sample in a half-gallon preserve jar, I shall endeavor to determine it. By such co-operation I hope to be able to present to the association a paper of general value, and more especially of value to those who have given me their aid.

HEADS OF DESIRED INFORMATION.

- I.—Nature of tastes, colors, odors, and objections.
- II.—The years, times, and seasons of occurrence.
- III.—The related appearances, growths, organisms, temperatures.
- IV.—Sources of supply, amount, manner of collection, reservoiring and distribution, so far as they may possibly throw light upon the nature of the difficulties encountered.
- V.—Where the troubles have occurred—in collecting basins, reservoirs, pipes, dead ends. Their connection with stagnation at any point, shallow water, swamps, contaminations.
- VI.—Prior investigations and analyses, explanations given by yourself and others. Yours very truly,
ALBERT R. LEEDS.

A CORRESPONDENT gives the following regarding Chambersburg, Pa., Water-Works:

Works erected in the year 1882 at a cost of \$53,000, and the past year operated 361 days; average daily consumption, 392,441 gallons; daily average of coal, 2,724 pounds; pumping expenses, \$1,812.64; pipes laid, over 8½ miles; total amount of receipts, \$7,299.23 for the past year, and is now paying us a handsome revenue, and are taking up a bond of \$1,000 each year besides interest on investment.

UNDER a new method of making porous earthenware, lately used in Germany, the clay is tempered and worked to the proper consistency with a mixture of water and naphthaline. The objects, after being formed, are placed in a dry kiln and gradually heated until the naphthaline is expelled, leaving the object perfectly and uniformly porous. The dry kilns are so built that all the naphthaline is drawn off and condensed, so that it can be used over again.—*The Engineer.*

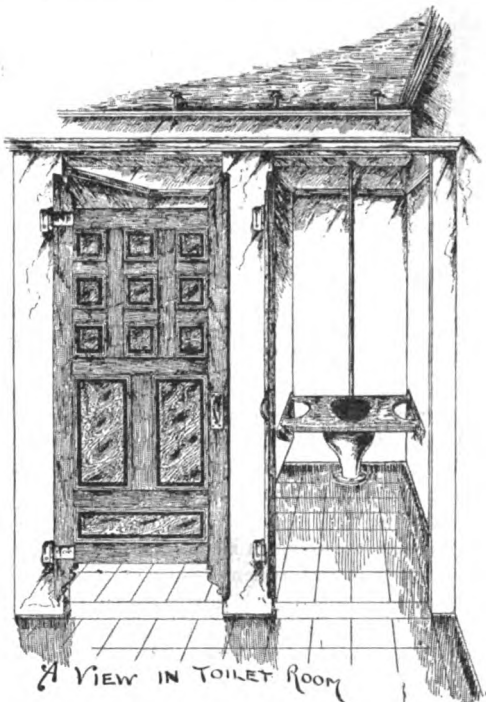


DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. I.

SKETCHES OF PLUMBING.

THE enlargement and alterations of the Equitable Life Insurance Company's principal building and offices in New York City are practically completed, and much of the details of the domestic engineering are nearly completed, and under which head we include heating, light-



(For Plan, See FIG. 1)

ing, water-supply, plumbing, elevator service, and all that goes to make up the engineering department of a great building, details and sketches of which we will give from time to time until they are completed.

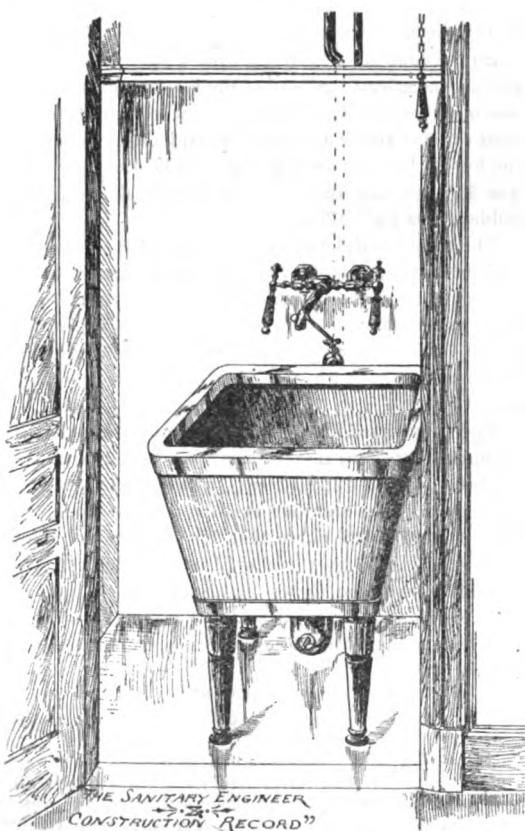


FIG. 7

The plumbing of this building is on a grand scale, and in keeping with the magnitude and finish of the remainder of the building.

The plumbing fixtures of the building consist of 125 water-closets, public and private, about an equal number of urinals, 200 wash-bowls, besides slop-sinks, etc.

The general plan of the public toilet-rooms are shown in Fig. 1. There are two rooms to each floor, in opposite halls, with five closets, two wash-bowls, and two urinals, as shown, to each room. The walls, floors, partitions, and all but the doors and ceilings, are polished marble, except where the partitions are sashed and glazed. A good idea of a single closet-stall, with its partitions and doors, can be obtained from the sketch "A View in Toilet

rooms for the closets taper from three to four inches, with 2-inch branches to each bowl. One long cistern is used for all the closets of a room. They are copper-lined wooden boxes, with ball-cock and overflow, the whole encased in marble.

The ends of the soil-vent and local vent are carried around the end of the room within the thickness of a partition to the urinals and bowls, and clean-out screws are placed on the outside in such a manner as to give a clear rim for cleaning from the corners.

Ladies' toilet-rooms of the same general arrangements are provided for the female operatives and clerks of the building.

Figure 2 is a sketch of the rough work of a line of water-closets in the cellar, and gives a very good idea of

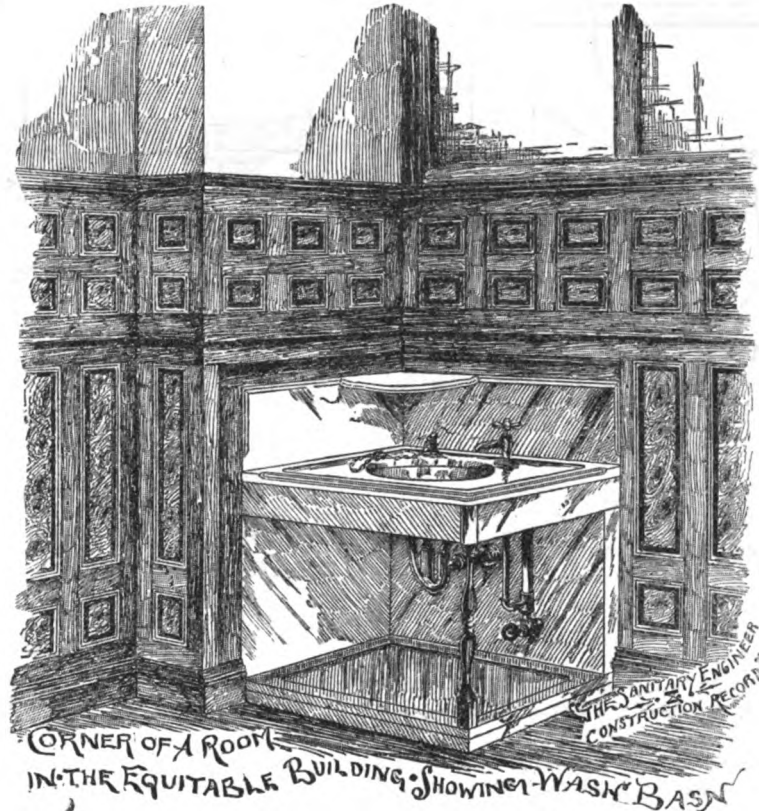


FIGURE 5.

Room." To the right of the figure in the ground plan is shown the relative position of the closets to the shafts through which the pipes and cables are run. These shafts are 4x8 feet, giving ample room for workmen to pass their whole length without going from floor to floor.

Within the shafts at the closet end are an 8-inch soil-pipe, a 6-inch back-air or vent pipe, and a local vent-pipe

the arrangement of details used throughout. This, however, in addition, shows a foot-vent of a line and a house-trap. The opening, it will be noticed, is within the thickness of the sidewalk arch. A grating, that can be lifted from the top, is used in the flag, and a pocket and cleaning-screw is used underneath the former as a receptacle for dirt or dust that may pass the grating and cap,

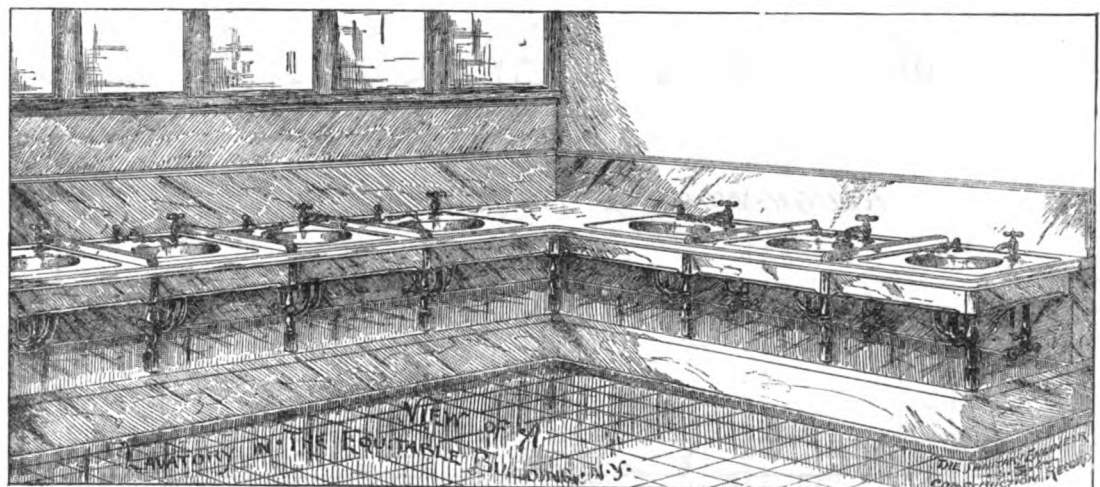


FIGURE 4.

of copper, which starts six inches in diameter at the lowest closet, and increases in size as it advances upward and receives more closet branches until it is twenty inches in diameter at the top.

The branches from these pipes pass through the walls of the shaft into the toilet-room. The soil-pipes are run beneath the floor in the usual manner, but the back-air and local vents are carried within a space formed by the marble lining of the room and the wall, as shown. The local vents are of copper throughout and taper, increasing in size from two inches at the first to six inches when it joins the upright pipe in the back-air

and the latter to facilitate its removal.

Figure 3 gives a very clear idea of the arrangement of the rough work for the urinals. A copper local vent is used as shown. The back-air pipes and traps are lead, and the waste-pipes iron.

Figure 4 is a view in the public lavatory showing range of wash-bowls, and Fig. 5 shows a single private wash-bowl in a corner of an office room.

Figure 6 shows the bowl in detail. The bowls are large and oval, 15x18 inches being the ordinary size used. The waste-pipes, vents and overflow-pipes shown are polished and plated brass, with ground union joints. The

joints of the overflow with the trap is screwed and sweated. The water-pipes and air-chamber are also polished brass, with special valve and fittings.

Figure 7 shows a slop-sink, as fitted at various places in closets on each floor. The sinks are heavy ceramic-ware, with brass flushing-rims. The legs and frames are also special brass castings. The waste, trap, and vent, which are shown in detail, are cast brass polished and buffed, and special brass bends are used on the waste-pipe behind the marble so as to give smoothness and an easy

flow to the water. Hot and cold water are supplied to these fixtures through a special combination faucet.

The master plumber is Mr. William H. Quick, and his local superintendent is Mr. John Kirkwood. Mr. George B. Post is the architect of the building.

Illustrated descriptions of the heating, ventilation, pneumatic service, elevator plant, etc., in this notable building, will appear in subsequent issues.

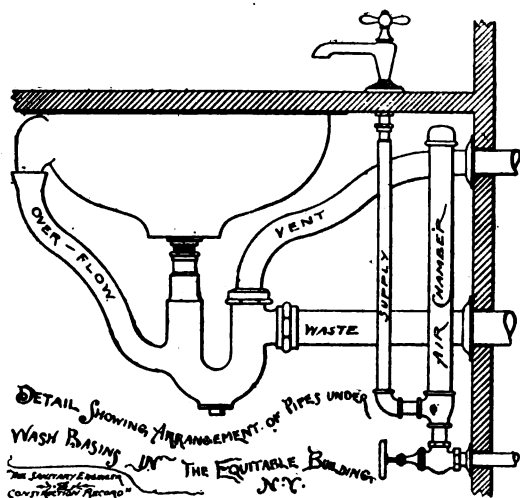
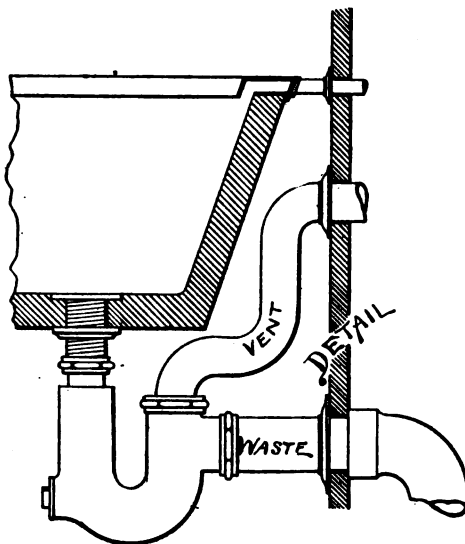


FIG. 6.



(See Fig. 7.)

Sectional view of slop-sink used in the Equitable Building.

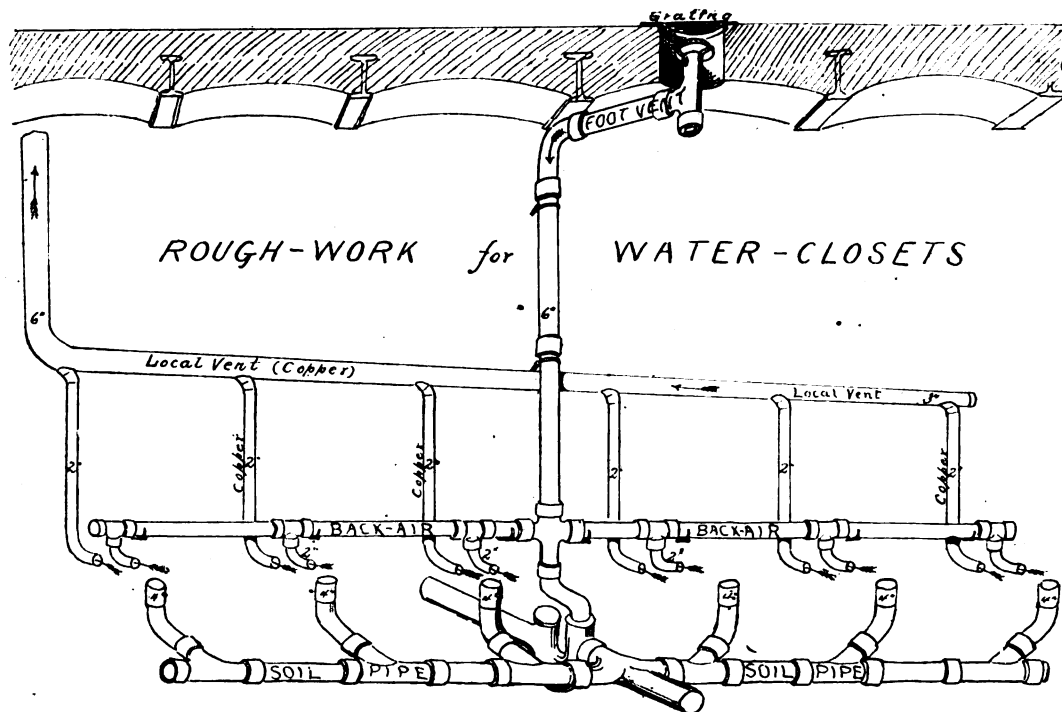


FIGURE 2.

ROUGH-WORK for URINALS

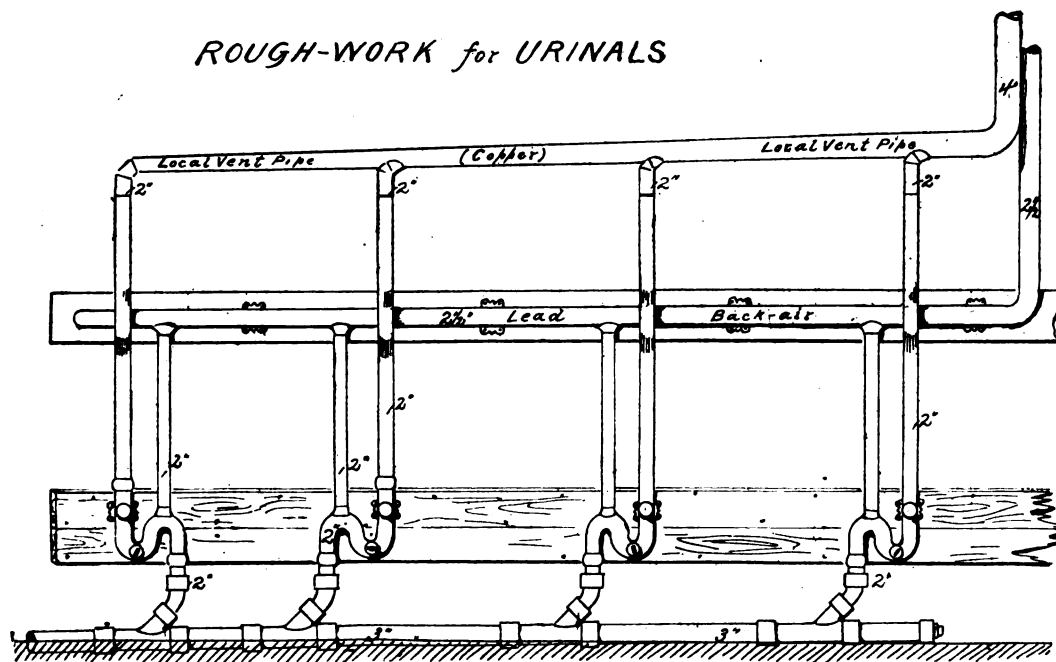


FIGURE 3.

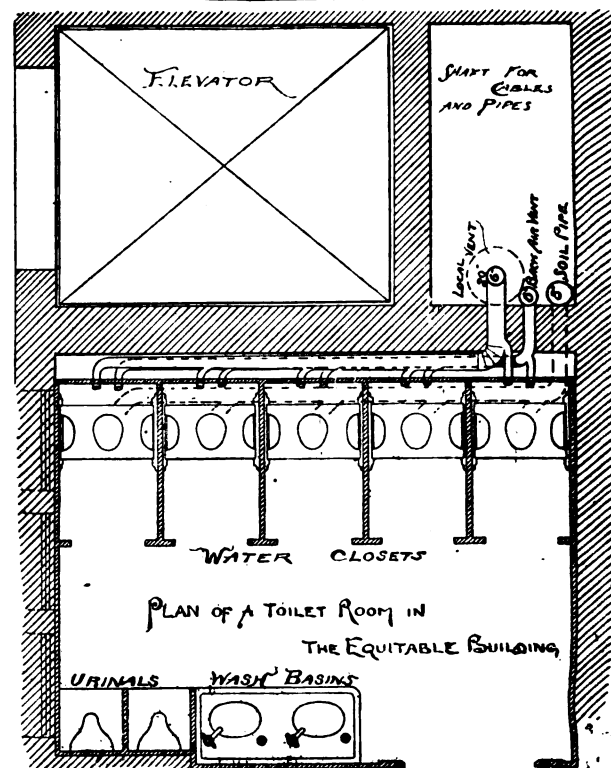


FIG. 1.

CONTROVERSY OVER LETTING THE CONTRACT FOR STEAM-HEATING, ETC., OF THE NEW RAMSEY COURT HOUSE, ST. PAUL, MINN.

THE present delay and controversy over the letting of the contract for the steam-heating, boilers, etc., of the new Court House, St. Paul, Minn., is only the result of the idiotic habit of trying to let large work of an engineering character without a proper specification, and it is a matter that we have repeatedly drawn attention to.

In this case the architect made what might be called a "specification of requirements"—that is, he did not say what he wanted, but he told bidders what he desired to see accomplished and asked them to propose methods of doing it and say what compensation they would expect if he accepted their plan. The result of the matter was nine engineering firms made different plans and submitted them, with their bids, each, of course, considering their own plan the most suitable for the building.

So far, the programme followed a practice that is too prevalent, and, in fact, is the only one where an architect is not able to enter into the detail of what he wants to construct and is not desirous of calling to his assistance the talent and experience required to make a proper specification necessary to secure what his clients expect. In this case, however, the practice was somewhat changed when the contract was to be awarded, since the highest bidder was selected instead of the lowest. This, of course, was objected to by the remainder, who naturally thought their designs entitled to some consideration, especially as the lowest bid was only \$16,972, while the one accepted was \$37,358, and fully one-third more than the second bidder, who was only \$26,929.

The unsuccessful bidders very naturally remonstrated, and the consequence was the committee hesitated to let the contract on the architect's recommendation. A pamphlet on the matter now comes to us of eighty pages, which is an endorsement of the architect's recommendations, published with the view of influencing the committee.

The "specification" on which the work was to be let occupies thirty-four lines of this book, and the balance of the book, with the exception of a page or so, is given to the reports of the architect and two experts called by himself. They try to prove that his specification of thirty-four lines was all that it should be, and that the contract should be let to the highest bidder.

In justice to all parties and for a comprehensive understanding of the matter we quote the specification in full as follows:

REQUIREMENTS.

The steam-heater will figure separately for boilers and without them. He must state the number of horse-power for his boiler, and if furnished with mud-drums and steam-domes, and safety-valves, and glass-gauge and steam-gauge, and water-cocks; the size of flues, if any; of what material, how many hand and manholes; what kind of

grates; baffle-plates and rods, britchen, damper and clean-out door in same, and hatches of iron; what kind of steel in boilers, Black Diamond or Otis steel, how riveted, hand or machine, rests, dampers, and anything else to give a clear understanding of what the work will be, how boiler is set, with brick laid in fire-clay, thickness of walls, how much space taken, and a plate showing position of boiler, length and size; if Murphy's Oil Extractor is used: what kind of ferrules in flues, with collars; the kind of a return-tank, the kind of steam-pump to return water to boiler (make and size) and size of all pipes for supply for boilers; size of steam-pumps to run hydraulic elevators, two in number; size of supply and return from building, what kind of system used, what kind of radiators, how far apart the pipes, and how many in each radiator, what kind of screens, how painted or bronzed, if electric automatic attachment is provided for each radiator, what kind of cocks, Jenkins or otherwise, what kind of air-valves, what kind of fitting.

The number of feet of radiation, and what degree of heat they will heat, when it is 30° below zero, how long that they will warrant it, and at what pressure on the building will it have to be to gain the required result, and in what time they will complete the building after contract is awarded.

The contractor will have to do all of the cutting required, and patching and finishing complete that may be damaged by the execution of this contract, and will be compelled to give a guarantee that his work will do all that is claimed for it.

The work to be paid for every month, less fifteen per cent., and when the work is all done and completed and accepted as satisfactory, the per cent. kept back to be paid.

Further comment is not necessary from us, excepting that we suggest to persons who cannot write a proper steam specification, or those who will not, that a simple and, we think, a better way than the above would be to follow the style of a physician's formula, thus:

R. Ramsey County Court House.

Boilers, quantum sufficium.

Pumps, q. s.

Radiators, q. s.

Apply when it is 30 below zero.

LEX.

It certainly saves time at first, although the trouble is sure to come later.

The following analysis of the bids submitted as made by one of the experts called by the architect may prove interesting to architects and engineers, as illustrating the range of ideas and prices entertained by men (contractors) who cannot be objected to as experts, as they certainly would not be in a court of justice, and this very range of expert opinion is the most forcible argument that can be put forth as to why the architect should draw his own plan and specification and take the responsibility of it, for good or bad.

Proposal of Thomas Davis.—Sum named, \$26,929.

Heating surface involved, 22,120 sq. ft.

Four heating boilers, one high-pressure boiler; total, 342.4 H. P.

Remarks—Submits no plans. Specifications indefinite in many particulars, but excellent in others. Several items involved in the work left out altogether. Radiation 33 per cent. too low. Pipes run in the basement will destroy basement rooms. I concur in the remarks made by the architect in his report.

Proposal of S. I. Pope & Co.—Sum named, \$19,700.

Heating surface, 18,000 sq. ft.

Four boilers, aggregating 288 H. P.

Steam-main, 12-inch.

Remarks—No plans. Specification quite well drawn, but calls for a high-pressure system, using not less than 12 steam-traps. Pipes run in basement, to which the same objection as made before obtains.

Proposal of Allan Black.—Sum named, \$23,000.

Heating surface, 18,244 sq. ft.

Four 60-inch boilers, presumably 75 H. P. each.

Steam-main, 9-inch.

Remarks—For plans Mr. Black submits tracings in pencil with radiators penciled on in red, but the heating surface, boiler-power, and size of pipes are all too small.

Proposal of Kenny Bros.—Remarks: Messrs. Kenny Bros. present a bid for four 60-inch boilers 18 feet long, with 50 tubes 4 inches in diameter in each, and one boiler 44 inches by 12 feet, having 3-inch tubes in the same. Their bid for boilers is very complete, and, by far, the clearest of any submitted, but the bidder forgot to specify the size of any outlets or nozzles.

Proposal of Holland & Thompson.—Sum named, \$23,844.

Heating surface, 17,813 sq. ft.

Four boilers 60-inch by 16 feet, aggregating 308 H. P.

Steam-main, 8-inch.

Remarks—The system involved in this bid is high-pressure, using steam-traps. The pipes, boilers, and radiating surface are too small for a possible successful operation.

Proposal of William Rodger & Co.—Sum named, \$20,645.

Heating surface, 18,998 sq. ft.

Steam-main, 8-inch.

Remarks—High-pressure and steam-traps; requires no further comment.

Proposal of Osborne & Co.—Sum named indefinite.

Heating surface, 12,000 sq. ft.

Three boilers?

Steam-main, 5-inch.

Remarks—Not having a "Webster's Unabridged" at hand, am a little at loss to interpret just what a system having "hydrothermaton," "retroduction," "revertibly connected," "binately connected," etc., etc., may comprise, but it is evident it has something to do with "hydrothermaton," at least the specification does.

Proposal of C. H. Parmelee.—Sum named, \$16,972.

Heating surface, 13,000 sq. ft.

Three boilers.

Steam-main, 10-inch.

Remarks—Requires no comments.

Proposal of A. O. Nepil.—Sum named, \$37,358.83.

Heating surface, 28,000 sq. ft.

Steam-main, 14-inch.

Five boilers, 60-inch by 16 feet, aggregating 385 H. P.

Remarks—The sum named above in this proposal includes elevator pumps and piping, with tanks, and a system of hot and cold water, including tanks and hot-water boilers.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

BOOKS ON SCHOOL ARCHITECTURE.

SIR: In reply to letter of Mr. William Duffus, in your issue of September 17, perhaps he refers to my little book on "Rural School Architecture," written for the United States Government, and published by the Bureau of Education at Washington, under the name of "Circular of Information, No. 4, 1880," which the Commissioner of Education of the province of Ontario has before been kind enough to notice with commendation. This can be obtained from the Bureau of Education, Washington, D. C. The work on City Schools must, I think, be one of the annual reports of the Massachusetts Board of Education, which contains a valuable monograph on the subject. I have not the book at hand, and do not recall the year, but, if it is not out of print, it may perhaps be had by addressing the Secretary of the Board at the State-House, in Boston.

Very truly yours, T. M. CLARK.

COMPARATIVE SANITARY CONDITION OF PRINCIPAL CITIES.

SANITARY DEPARTMENT,
1 Montrose Street, Glasgow,
September 22, 1887.

SIR: I observed in your issue of September 3 some figures published by Dr. Bertillon, of Paris, comparing the death-rates of various cities from zymotic diseases. I do not know where he obtained them, but so far as Glasgow is concerned I shall be obliged if you will kindly correct them. The number of deaths per 100,000 of the population from small-pox for 1886 was 0.4, not 68 as stated in THE ENGINEERING AND BUILDING RECORD. There were only two deaths. For diphtheria the rate was 18 per 100,000, and not 29 as stated.

I am, yours truly,
PETER FYFE, Sanitary Inspector.

SEWER-VENTILATION.

BOROUGH ENGINEER'S OFFICE,
PORTSMOUTH, ENG., September 20, 1887.

SIR: As a member of a Committee of the Association of Municipal Engineers appointed to investigate and report upon the subject of sewer-ventilation, I shall be much obliged if any of your readers will be kind enough to send me the results of any experiments they have made or any verified facts in connection with the subject.

The committee are anxious to obtain facts upon the subject rather than theories, so as to form a record or history of this important sanitary question, and I feel sure that if you will kindly give publicity to the requirements of the committee we shall be furnished with all that is known about sewer-ventilation upon your side of the water.

I am, sir, your obedient servant,
H. PERCY BOULNOIS, M. Inst. C. E.

HOT-WATER CIRCULATION FROM TWO BOILERS HEATED BY TWO RANGES.

SCRANTON, August 31, 1887.

SIR: Will you kindly inform me through your paper what I must do to make two boilers work together, with fire in both ranges, as I show on the cut? I remain as ever,
T. J. C.

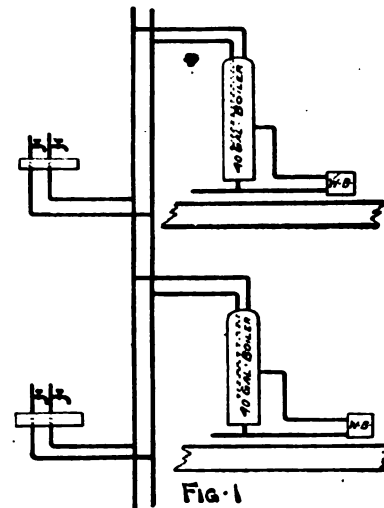


Fig. 1

[You send us very little data to base a reply upon.

(1) You do not say whether your water-supply is from the street pressure or from a tank in the top of the house.

(2) You do not say whether the two fires are under the one control or not.

If each boiler and each sink belongs to different floors of an apartment or tenement house, then each should be supplied separately from any source whatsoever and have separate vent-pipes if from a tank supply. Otherwise serious complications may follow if one boiler is out of use, such as mixing hot and cold water through different pipes, etc. For instance, while drawing hot water at the lower sink, and the upper boiler only being in use, it would be found that cold water would pass from the cold boiler through what would be the hot-water pipe and mix with the hot water from the upper boiler on its way to the sink.

The only condition under which your two boilers can work together, as shown in your sketch, is when there is a fire in both ranges. Of course, stop-cocks may be put into the cold and hot pipes at the tops of the boilers to shut off the one that is not in use, but if this is done they will be forgotten sometime and disaster will follow.

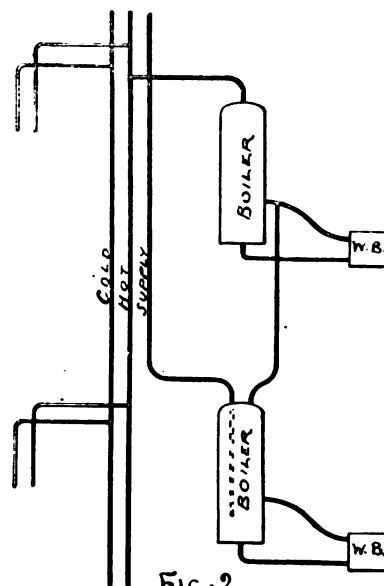


Fig. 2

If your arrangement is required for a summer and winter kitchen, in which there is a fire alternately, or for a kitchen and laundry where both fires are under one control and run together, then you may fit them up as shown in Fig. 2. Take the cold supply to the lower boiler and connect the hot or flow pipe of the same with the upper boiler, entering it almost where you please. Then, when both are run together, as on a washing day, you can draw abundance of hot water from the upper one, as the water of both goes there, and on ordinary days you have the upper one alone. Should the supply be from the street a check-valve should be used in it near the lower boiler.]

Novelties.

BENDING PIPES.

We herewith illustrate a recent patent for a novel pipe-bending machine issued to James H. Kelly and Charles H. Broad, of Rochester, N. Y.

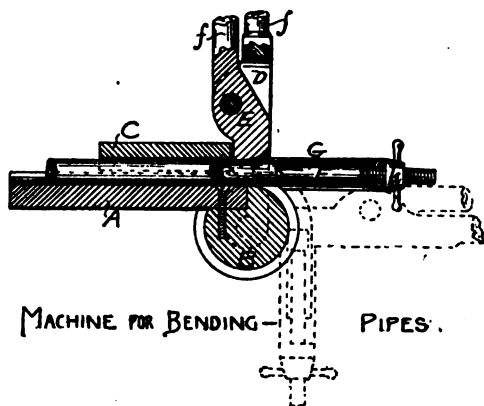
It looks to us as if this apparatus might be used by plumbers and others to good advantage in making bends in thin lead pipes of comparatively large diameter, and that for making $1\frac{1}{4}$, $1\frac{1}{2}$ or 2 inch pipe bends on the job it would prove serviceable.

It consists of a grooved form A, with a head B of the size of the bend and also grooved, and a clamp C.

D is a yoke pivoted on the axis of the forming head, and E is a die pivoted in the yoke, each part having a lever or handle, F, by which it is operated. The lower end of the die is grooved to fit the top of the tube or pipe.

G is a stirrup attached to the yoke and moving with it.

F is the rod or mandrel through the medium of which the bending is done. This rod may either be straight and of the same diameter its whole length, or it may have an



enlargement forming a head at the inner end, as shown in the drawing. The outer end of the rod rests in the stirrup, and is held to it by any suitable means, that shown in the drawing being a nut, H, which screws upon a thread on the rod, and thus serves as a gauge to adjust the rod forward or back.

To bend the tube or pipe, the same is secured on the form, the rod is inserted on in the projecting end of the tube or pipe, its end resting over the form, and the yoke, carrying the die, the stirrup, and the rod, is then swung around the form, the rod in that case causing a simultaneous drawing and bending movement of the tube around the form, and making the bend as it progresses, and the circular end or head, resting at the point where the bending takes place, forms a core to preserve the circle of the tube, and leaves it practically circular in cross-section its entire length.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kriegerbocker Gas-Light Company.	Equitable Gas-Light Company.
October 1.....	25.70	21.28	22.33	31.03	30.05	24.72	30.18

E. G. LOVE, Ph.D., *Gas Examiner.*

THE fifteenth annual meeting of the American Gas-Light Association will be held in this city on October 19, 20, and 21. The following papers have been promised, and others will doubtless be added to the list before the meeting: "Fuel-Gas," by Emerson McMillin, of Columbus, O.; "Illumination vs. Candle-Power," by Alex. C. Humphreys, of Philadelphia, Pa.; "Utilization of Residential Products," by Charles H. Nettleton, of Birmingham, Conn.; "The Advantages of Gas Companies Engaging in the Electric-Light Business," by E. J. King, of Jacksonville, Ill.; "Water-Gas," by Walton Clark; "Development of the Half-Depth Regenerative Furnace, and Some of the Results," by V. B. Webber, of New York; "The Comparative Illuminating Power of Gas Purified with Lime vs. Oxide of Iron," by C. W. Blodget, of Brooklyn.

WESTERN ASSOCIATION OF ARCHITECTS.

THE following circular has been issued: "The Western Association of Architects was organized to encourage the development and progress of architecture, and to establish uniformity of action and understanding among the architects of the West and South, so that their combined influence should tend to elevate professional standards throughout the country.

"Believing comparison and consultation to be among the best methods to induce interest in the growth of the profession, in behalf of the Board of Directors of the Western Association of Architects, we extend to you a cordial invitation to send to the committee in charge of the drawing exhibit at the Cincinnati convention such pencil or pen and ink sketches, water-color drawings, photographs, and models of a few of the buildings designed and executed under your supervision during the past ten years. It is the hope of the association that the exhibition at the convention will be in all its departments unusually full and widely illustrative, so that architects from all parts of the country, whether members of the association or not, will have an opportunity for a wide survey of work done throughout the country during this period of time. Your co-operation in this, which we believe to be a very important work, will be highly appreciated.

"The association will pay all costs of transportation to Cincinnati and return, as well as charges for boxing, shipping, hanging, etc.

"Should it be your pleasure to contribute to the exhibition will you kindly inform the Committee on Drawing Exhibit at your earliest convenience of the number and size of drawings you will send.

"The Western Association will also be gratified to have your presence and co-operation at the next convention, which we trust will be one of interest and significance."

JOHN W. ROOT, President,

115 Monroe Street, Chicago, Ill.

D. ADLER, Chairman Board of Directors,
58 Borden Block, Chicago, Ill.

J. F. ALEXANDER, Secretary,

Corner Fourth and Main Street, Lafayette, Ind.

The Western Association has also issued a similar invitation on behalf of the American Institute of Architects, the convention of which is to be held in Chicago, beginning October 19 next. Drawings or photographs for the American Institute of Architects' Exhibition should be sent to Henry Lord Gay, Chairman of the Committee on Drawing Exhibition, 15 East Washington Street, Chicago, Ill. The American Institute of Architects will pay all costs of transportation, boxing, etc., to Chicago and return.

ILLINOIS STATE ARCHITECTS' ASSOCIATION.

THE annual meeting of the Illinois State Association of Architects was held October 1. The Executive Committee reported the arrangements made for the reception and entertainment of the American Institute of Architects, which will hold its twenty-first annual convention in Chicago October 19, 20 and 21. The headquarters will be at the Leland Hotel.

The election of officers for the ensuing year resulted as follows: President, Samuel A. Treat; First Vice-President, L. D. Cleveland; Second Vice-President, Clarence L. Stiles; Treasurer, H. W. Hill; Secretary, R. C. Berlin; Executive Committee, the President and L. H. Sullivan, John W. Root, Alfred Smith, and W. W. Clay.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

THE third fall meeting was held October 5, Mr. W. E. Worthen in the chair. The meeting was principally devoted to business of the society.

Mr. J. P. Davis presented a resolution for the appointment of a committee to consider and report an amendment to the constitution relative to the mode of electing members.

This resolution was discussed by Messrs. Davis, Wellington, Dorsey, North, Bogart, O'Rourke, Croes, and Brinckerhoff.

After a lengthy discussion the resolution passed, and the President appointed on the committee Messrs. Davis, Wellington, and Paine.

A report was received from the committee appointed at the last annual convention to consider and report on the advisability of creating the grade of Student in the society. This report was referred to the committee for further consideration and to report.

The report was discussed by Messrs. Croes, Paine North, Bogart, Davis, and Wellington.

A statement of excessive rainfall was made by Mr. William Rumble, which occurred October 30, 1866, at Morrisania. Rain had fallen during the previous night. The following day the rain fell from 7:45 A. M. until 9:15 A. M. to a depth of $1\frac{1}{8}$ inches, which is at a rate of $1\frac{1}{8}$ inches per hour.

At 10 A. M. there was running in Mill Brook at the railroad crossing 100 cubic feet per second, or 360,000 cubic feet per hour. The area of Mill Brook water-shed above the point of measurement is about 1,790 acres, and the amount of rainfall on this area at the above rate will equal 7,472,355 cubic feet per hour. The quantity given as running in the stream would amount to about $4\frac{1}{4}$ per cent. of the net fall.

The following were elected:

For Members.—Henry St. Leger Coppee, Civil Engineer, Vicksburg, Miss.; Henry Clay Derrick, in charge of preliminary surveys Lynchburg, Halifax, and North Carolina Railroad, Halifax Court-House, Va.; Joseph Norton Greene, Chief Engineer and President Maine Shore Line Railroad, Willimantic, Conn.; Edward Buckingham Guthrie, (Elected Associate September 3, 1884,) Deputy City Engineer, Buffalo, N. Y.; Charles Edward Hewitt, (U. S. Military Academy 1880,) Engineer New Jersey Steel and Iron Co., Trenton, N. J.; Wynkoop Kiersted, (Rens. Pol. 1880,) engaged in general engineering work and designing water-works for Falls City, Neb.; James Imbrie Miller, Principal Assistant Engineer in charge of Northern District New Croton Aqueduct, Tarrytown, N. Y.; Palmer Chamberlaine Reckets, (Rens. Pol. 1875,) Engineer of bridge over Genesee River at Rochester, N. Y., for Rome, Watertown, and Ogdensburg Railroad, and Engineer of bridge for Monroe Co., N. Y.; Granville Wheaton Shaw, U. S. Assistant Engineer in charge Improving Falls of Ohio River at Louisville, Ky., and enlargement of Louisville and Portland Canal, Louisville, Ky.

For Associate.—Gratz Mordecai, Expert of U. S. Bureau of Labor, Washington, D. C.

HOT-WATER SUPPLY.*

THIS is a practical treatise by a practical man upon the fitting, etc., of hot-water apparatus for domestic purposes and general use, and is an exposition of modern practice in dwellings, etc., in London and elsewhere in England, and must prove of interest to American plumbers who are desirous of knowing all they can of the practice in Great Britain.

It makes no scientific pretensions, but gives considerable practical data as to sizes, etc., to be used, gives opinions on what, in the estimate of the writer, should be used, and points out objectionable features that should be avoided. It is well illustrated, and contains several full-page illustrations of house plans, etc., and systems showing how a few rooms or the conservatory of a house may be warmed from the kitchen or domestic boiler. It cautions the fitter or user, however, against placing too much reliance on these little heating apparatus, and points out the fact that a conservatory thus warmed is likely to be left without heat in the night-time, and just when it is most required. He also adds: "Coils can be, and are, worked from hot-water supply services at all times, but the general results are not altogether satisfactory, as the boiler (water-back) must be increased in power considerably to compensate for the loss of heat, and in summer annoyances experienced by the boiler (water-back) overdoing its work, etc." This journal in its Correspondence columns, has pointed out just this difficulty to American readers who try to successfully warm part of a house from the water-back of the kitchen-range. It is evident, from a perusal of this little work, that the author has had intimate practical experience with his subject.

PERSONAL.

MR. W. H. BRINCKERHOFF, M. Am. Soc. C. E., has accepted a position on the editorial staff of THE ENGINEERING AND BUILDING RECORD.

MR. JOHN BOGART, Secretary of the American Society of Civil Engineers, was recently unanimously nominated by the Democratic State Convention for the position of State Engineer and Surveyor of New York. It is understood that Mr. Bogart has declined the nomination.

CAPTAIN LAFAYETTE E. CAMPBELL, U. S. A., has been ordered to Denver to take charge of the construction of the military post near that city.

MR. EDWIN THACHER, Chief Engineer of the Keystone Bridge Company, has accepted the position of Chief Engineer to the Decatur Bridge Company, recently organized at Decatur, Ala., and will proceed to his new field in a few weeks.

* A Practical Treatise upon the Fitting of Hot-Water Apparatus for Domestic and General Purposes. By F. Dye. E. & F. N. Spon, 125 Strand, London, and 35 Murray Street, New York. Price, \$1.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

JERSEY CITY, N. J.—The Building Committee of the Board of Freeholders has awarded the \$300 premium for the best set of plans for the proposed Hall of Records to L. H. Gaile. It was also resolved to recommend the board to allow Digon & Co. and Anderson & Sailer \$75 each for the plans prepared by them.

ENGINEERING COMPETITIONS.

WILLIAM POTTS, Chief Examiner, will hold an open competitive examination for assistant engineers, levelers and rodmen at the rooms of the American Society of Civil Engineers, No. 127 East Twenty-third Street, New York City, on October 18. Written applications of candidates shall be made on or before October 12, to the Secretary of the New York Civil Service Commission, Albany, N. Y., who will furnish to applicants such further information as may be necessary. The examination is only open to citizens of the State who have been residents for at least one year.



For works for which proposals are requested see also the "Proposal Column," pages 505-507-511-512.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE. ETC.

SODOM DAM, NEW YORK.

The plans for the Sodom Dam work have been adopted by the Aqueduct Commissioners and the specifications for the work will be ready during the first part of next week.

OMAHA, NEB.—The water-works is making considerable extensions of mains.

BEALTON, CAL.—Water and gas works will be constructed here by a stock company.

DEPOSIT, N. Y., September 30.—Our correspondent writes: "This village is supplied with first-class water-works. A little over two years ago a stock company was formed here, and the gravity system adopted. A large reservoir was built one and one-half miles from village. The place is supplied with an abundance of good water, with a head of about 150 feet."

ORLANDO, CAL.—Our correspondent writes: "There has been considerable talk on the question of irrigation in Colusa and Tehama Counties, but no immediate action has been taken in the matter until this month, when an election was held in a district formed of the north part of Colusa and a small part of Tehama, representing about 14,000 acres, for the purpose of irrigating the same from Stoney Creek. The irrigationists were successful, and we think work on the ditch will soon be commenced."

MONTPELIER, VT., September 30.—Our correspondent writes: "This town has established excellent water-works within the last three years, taking water from a large pond (or lake) about four miles distant, and voting, at a meeting held this week, to lay a second line of pipe to the reservoir, about three miles, I think."

LOS ANGELES, CAL.—City Council has passed an ordinance providing for the construction of \$1,000,000 of sewers.

DETROIT, MICH.—The Board of Water Commissioners have ordered the laying of much water-mains.

NEW BEDFORD, MASS.—Our correspondent writes: "Nothing is being done towards the establishment of water-works in this city. Water-works were established, and have been in operation, for nearly twenty years."

SAN JOSE, CAL.—City Council, September 26, adopted specifications for about one mile of sewers.

PITTSBURG, PA.—A large amount of sewer-work is projected. Address the Board of Viewers.

BROCKTON, MASS., is considering the advisability of doing about \$19,000 of sewer and drainage work.

TEMPLETON, CAL., will have a water-supply, taking water from Salinas River.

BOSTON, MASS.—Mayor O'Brien has just sent a message to the City Council urging the construction of certain sewers, to cost \$130,000.

SANTA ROSA, CAL.—T. J. Brooks and J. B. Davis and associates, of Santa Rosa and San Francisco, have taken up 4,000 inches of water of Mark West Creek, to be used for family and irrigation purposes in the city of Santa Rosa. The water is to be brought in iron pipes.

KUTZTOWN, BERKS CO., PA.—A company is being formed here for the purpose of building water-works.

HAYWARDS, CAL.—Address Col. William Haywards or Chisholm & Farrell about proposed water-works here. A company has been organized to erect water-works. It is expected that the enterprise will be pushed to rapid completion.

TUSCUMBIA, ALA.—Organized is the East Sheffield and Tuscumbia Water Company with a capital stock of \$50,000, and the following board of directors: W. S. White, Ed. B. Almor, C. D. Woodson, John A. Steele, A. H. Keller, Robert Cloud and Henry B. Tompkins.

ST. PAUL, MINN.—McRitchie & Nicol, of Chicago, are the contractors for laying the water main across the river at State Street.

ANNISTON, ALA.—Plans and specifications for a system of sewerage for the thickly inhabited part of the city were submitted to the Council September 29 by City Engineer Ott. The work is to be done by contract.

GREENSBORO, N. C., October 3.—Our correspondent writes: "Contract for water-works at this place has not been let yet."

NORTH EASTON, MASS.—Town meeting October 1 voted to increase the water-supply at a cost of \$15,000. A. A. Gilmore should be addressed.

LAKE, ILL., proposes to have a good sewerage system constructed. Address the Town Clerk.

KEOKUK, IOWA.—City Engineer Eimbeck has made a report to the Finance Committee showing the need of new sewers, to be constructed at a cost of \$50,000 to \$60,000. The matter is urgent, and, it is believed, the sewers will be built.

SHELL LAKE, WIS., September 30.—Our correspondent writes: "It is only a little talk for the present about water-works. It looks as though there should not be any this fall. If any to be I will let you know."

SAN DIEGO, CAL.—The Development Company, of San Quentin, Lower California, and the Land and Town Company, also of San Quentin, are organized to build up towns, construct water-works, etc. J. D. Hanbury, of Hanbury & Turrey, San Diego, is interested in both companies.

SUNVIEW, COL.—The Sunview Reservoir and Ditch Company has filed articles of incorporation. The company proposes to construct ditches and reservoirs on Little Fountain and Rock Creeks in El Paso County; trustees: Eliza G. Womack, Samuel R. Womack, and Theodore H. Lowe are named.

VINEYARD HAVEN, MASS.—Our correspondent writes about water-works: "Works in full blast; stand-pipe and wells nearly finished; pipes being placed and houses being plumbed fast."

MACHIAS, ME.—A town meeting has been held to consider the obtaining of a water-supply from a pond in Marshfield, at a cost of \$25,000.

ORANGEBURG, S. C., contemplates enlarging its water-works plant.

TARENTUM, PA.—Our correspondent writes: "The only water-supply is piped from several large springs and supplies about 300 families. There is a company here that have a charter, and it is recorded, and that is as far as they have gone. It will be some time before they begin operation."

HUDSON, N. Y.—The contract for building the State Street sewer has been given to Brennan Bros., at \$5,945.

LODI, CAL.—Bids were opened at Lodi recently for completing the Mokelumne Ditch and Irrigation Company's dam, near Burson, Calaveras County. The contract was awarded to Walker & Merwin, of Chico, for \$17,072.

CORPUS CHRISTI, TEX.—The American Well Company has submitted two propositions for the sinking of an artesian well—first, guaranteeing a flow of 50,000 gallons every twenty-four hours, sinking the well until the required amount of water was secured; in case the well would not flow, to furnish a boiler and relay pump, assuming all risks in consideration of \$15,500. Second, to sink one or more wells to a depth of 800 feet, until a 50,000-gallon is secured, at \$10 per foot.

NORWAY, WIS.—The town has undertaken a great drainage scheme in the swamps of Wind and Muskego Lakes. A canal will be constructed. Total cost estimated at \$400,000.

WORCESTER, MASS.—Address Major Winslow about the proposed introduction of filtering processes for the sewage. A committee has been appointed to consider the matter; immediate attention necessary.

LANSINGBURG, N. Y.—Engineer Franklin has prepared plans for a new reservoir for the water-works. The Water Board will take action at the next meeting.

SPRINGFIELD, ILL.—City Council has before it a plan for enlarging the water-supply with new galleries, etc., on the Sangamon River.

BOWLING GREEN, O., voted October 4 on the introduction of a supply of water.

BROOKFIELD, MASS.—Town meeting October 4 appointed a committee to obtain plans and estimates for a water-supply. Address the Town Clerk.

DUBUQUE, IOWA.—City election went against the proposition of City Council to raise funds for a sewerage system, and the matter will be dropped.

RICHFIELD, KAN.—Address F. F. Stevens about a new water company here.

FORT COLLINS, COL.—Sewers will be built here.

BROOKLYN.—Chief Engineer Van Buren has submitted his report on relief sewers to the Department of City Works. The estimate is \$149,000.

CHICAGO, October 4.—The City Engineer is about to advertise for bids for the construction of the new water tunnel, extending four miles into the lake. The tunnel will be eight feet in diameter, four miles in length, will cost about \$600,000. There will also be additional pumping-engines, to cost about \$500,000.

KINSLEY, KAN., has contracted for the building of water-works.

WAYCROSS, GEO., will obtain a supply of water from artesian wells. The contractor is T. M. Dexter, of Brunswick.

RALEIGH, N. C.—On report of Professor J. L. Ludlow, the water-works have been accepted by the city.

SYRACUSE, N. Y.—Bids for constructing sewers were opened by Common Council September 26. The lowest bidders were Martin & Sprague, \$22,125.56, for the James Street sewer, and Hugh Purnell, \$4,687.50 for the Gifford Street sewer.

GRIFFIN, GEO., wants water-works.

LOS PASOS, CAL.—The Los Pasos Land and Water Company has been incorporated; Thomas R. Bard, Dan McFarlane, and others.

WATER-WORKS are projected in the following towns: Greeley, Col.; Pontiac, Mich., \$75,000; Georgetown, Ky.; Westboro, Mass.; Montpelier, Vt., \$30,000; Ortonville, Minn., \$10,000.

BALTIMORE, MD.—The Consumers' Water and Illuminating Co., capital stock, \$200,000, has been chartered to supply Woodberry, Hampden and vicinity with water and gas. The directors are Jeremiah D. Mallory, Richard J. Capron, William M. Busey, George B. Morton, and William H. Watkins.

CLEVELAND, O.—City Council will appropriate \$5,000 for topographical maps for the work of purifying the Cuyahoga River.

GREENSBURG, PA.—The Westmoreland Water Co. will receive bids until the 17th inst. for the construction of water-works in Greensburg, Pa. For information address George H. Fox, Secretary, Kittanning, Pa.

MCKEESPORT, PA.—Mr. Joseph Ecoff, Superintendent of the water-works writes: "Water-works were established in this city in the year 1882 and have been in successful operation ever since, but now, owing to the large increase in population, the demand upon the works is so great as to call for much larger pumping capacity. The present pumping capacity is 3,000,000 gallons, which comprises two 1½ million gallon high-pressure 'Worthington' engines, and it is now proposed to increase the above by the addition of one 5,000,000 gallon compound condensing engine, for which bids were opened by our water committee on September 22, but as the matter at this date has not been decided it is still a question as to which particular engine will be erected. It is expected to publish the result of the letting in due time."

FAR ROCKAWAY, L. I.—It is probable that conclusive steps will shortly be taken towards a complete system of sewerage for this place.

GREENBUSH, N. Y.—The specifications and plans for \$10,000 of sewer work are before the Sewer Commission. Address the City Clerk.

EAST TAWAS, MICH.—Water works will be erected here by a firm of contractors from Grand Haven, Mich. The bid was \$48,000.

GREENVILLE, MICH.—A Special election will be held here October 12, to settle the water works question.

MT. PLEASANT, IOWA.—The American Trust and Loan Company has bought the Mt. Pleasant water works.

EASTON, MASS.—A meeting of the North Easton Village District Association is to be held, to determine whether the district will appropriate money for the extension of the water works.

HARRISBURG, PA.—A number of small water companies in the Philadelphia suburbs have filed notice of large increase in their capital stock, as follows: Lower Merion Water Company, from \$1,000 to \$500,000; Haverford Water Company, from \$1,000 to \$100,000; Radnor Water Company, from \$1,000 to \$100,000.

MILWAUKEE.—Water-mains will be laid in Sixth Street from North Avenue to Lee Street, also in Highland Boulevard from Washington Avenue to Twenty-ninth Street, two blocks. Water-meters are being put in here in great numbers in stores and public places. The Legislature last winter passed a law making the use of meters in public places and stores compulsory, and the Water Department is serving notices as fast as the meters arrive.

MILWAUKEE.—A pipe sewer will be laid in Twenty-first Street from Chestnut Street to Cold Spring Avenue, one block. A brick sewer in Mitchell Street, from Bismarck Avenue to a point twelve feet west of Eleventh Avenue.

PITTSBURG, PA.—The Controller has just advertised for new water-pipe.

KYLE, TEX.—The Kyle Water Company, capital stock \$15,000, has been incorporated for the purpose of building water-works.

CHARLOTTE, N. C.—Correspondence is invited by the City Council in regard to a system of water-works.

MARIETTA, GEO.—A proposition has been made by Proctor Lawrence to erect a system of water-works.

CHARLESTON, S.C.—The Charleston Water-Works Co. will erect an additional reservoir with a capacity of 5,000,000 gallons. The new reservoir will be about 200x250 feet and 15 to 18 feet high.

GAS AND ELECTRIC-LIGHTING.

BALTIMORE, MD.—Incorporated is the Waterhouse Electric Company, of Baltimore, to erect electric-light plants. Robert R. Zell, William R. Pope, and others.

NEWARK, N. J.—The contract for furnishing lamp-posts has been given to Mayher, Robinson & Flockhart, at \$5.10 per post.

BOWLING GREEN, KY.—The City Council of this city has appointed a committee to-night to advertise for bids and contract for the construction of the necessary works for the lighting of the city with electric-light. H. E. Jenkins is chairman of the committee.

LITTLE ROCK, ARK., is negotiating for electric-lights in the streets. Address Mayor Whipple.

LEWISTON, ME.—On September 29 the Board of Aldermen awarded the contract for lighting the streets to the American Electric Manufacturing Company, of New York City. 100 arc-lights, of 200 candle-power each, will be erected.

BAY CITY, MICH., is receiving proposals for lighting the streets with gas and electric-lights.

LEWISTON, ME.—The question of lighting the streets of the city to the exclusion of gas has finally been settled. At a recent meeting of the Board of Aldermen and Common Council, bids from ten different electric-light companies were considered, and resulted in the contract being awarded to the American Electric Manufacturing Co., of New York.

GAS-LINE.—The contract for laying forty miles of gas-mains for the Bridgewater, Pa., Gas Company has been given to George Free.

SAN FRANCISCO, CAL.—The Standard Gas-Light and Fuel Company, of San Francisco has filed articles of incorporation. The capital stock is \$3,000,000. The incorporators are Henry McGurran, William B. Cluff, James D. Boyer, B. B. Duncan, and William F. Harris.

EAST ORANGE, N. J.—The Edison Illuminating Company, of Orange, has asked for a franchise permitting the company to lay wires and establish plant for electric-lighting.

COLUMBUS, O.—The Columbus Electric-Light Company has made a proposition to City Council to erect and maintain lamps at \$93 each per annum. No action has yet been taken. Address Councilman George E. Hardy.

DOUGLASS, WYO. T.—The Wyoming Oil and Mining Company is incorporated; capital, \$1,000,000.

POMONA, CAL.—Articles of incorporation have been filed by the Pomona Gas and Electric-Light Company. The directors are H. A. Palmer, J. E. Packard, James T. Taylor, O. F. Griffin, Charles French, C. C. Olmstead, and G. W. Lynch.

JERSEY CITY, N. J.—Bids for lighting the streets were opened September 30, as follows: The United Improvement Company, gas, 925 lights in old Jersey City and Lafayette, \$18 per lamp yearly; 1,225 lamps in old Bergen and Hudson cities, \$19.50 per lamp yearly; 125 lights in Greenville, \$25 per lamp monthly.

The New York and New Jersey Globe Gas Light Company, 1,000 to 1,500 naphtha gas lamps, at \$1.62½ per lamp monthly.

The Jersey City Electric-Light Company, 40 electric lamps, at 40 cents per lamp per night, or 33 cents if the lamps are lit every night in the year.

No action is yet taken.

HYDE PARK, MASS.—The town has contracted with the American Electric Manufacturing Company to light the streets at \$70 per lamp per annum.

CORPUS CHRISTI, TEX.—An electric-light company will be soon organized here to light the streets.

ORANGE, N. J., has granted a franchise to the Edison Illuminating Company to erect a plant for street lighting.

SANFORD, ME.—Incorporated is the Sanford Light and Water Company, to operate electric-lights in Sanford.

ANTIGO, WIS.—A company has been formed here, with \$10,000 capital, to erect electric street-lights.

ROCHESTER, MINN.—The city has granted a franchise to the Electric-Light Company, and work on plant will be begun at once. Charles Streeter, Superintendent of Water-Works, can give further information.

RED BANK, N. J.—An electric-light plant for streets is wanted here. The town is ready to grant franchise to proper parties.

BRATTLEBORO, VT.—An electric-light company has been organized here.

AMSTERDAM, N. Y.—The city has made a contract with the Edison Electric-Light Company to erect 67 arc-lights of 2,000-candle power each.

ONEONTA, N. Y.—The Oneonta Electric-Light and Power Company has been organized to erect plant for street-lighting. Address Sawen & Connant for particulars.

PORTLAND, ME.—The Committee on Streets and Lamps will make contracts for street-lighting, etc.

TORONTO, ONT.—The Committee on Street-Lighting reports as follows: The plant by the Bell Electric-Light System would cost \$10,000, and the annual current expense \$4,000; this would give 50 street-lights at a cost of 50 cents a night, and allow of 25 shop-lights at 25 cents per night. The Toronto Electric-Light Company tender at 55 cents per light for 2,000-candle-power lights, with an electro-motive force of 45 volts. If the city and town lamps combined reach 200, a reduction of five cents per light will be made. The gas company tender for three years with burners consuming 3½ cubic feet per hour, each lamp to cost \$20.50 per annum, provided the company has a monopoly of the lighting; 100 Lambeth lights, burning 25 cubic feet per hour, 150 candle-power, at \$73 per lamp, or 20 cents per night. The matter was referred.

AMSTERDAM, N. Y.—The Common Council has decided to erect sixty-seven arc lights of the Thomson-Houston electric system in the streets. The cost is \$6,683.25 per year for sixty-seven lights of 1,200 candle-power each.

PATERSON, N. J.—The Paterson Electric Light Company has decided to establish the incandescent light system and supply houses and business places all over the city. Provisions for 3,000 lights will be made immediately.

SPRINGFIELD, ILL.—An incorporation license has been issued by the Secretary of State to the Peru Electric-Light and Water Company, at Peru, Ill.; capital stock, \$8,000; to furnish water, steam, and electric-power. Incorporators W. K. Hoagland, Theodore Wiberling, and William E. Moore.

MEMPHIS, TENN.—The Equitable Gas-Light Co. have purchased 25 acres of land outside the city limits, at a cost of \$50,000, upon which they will erect their plant and residence for mechanics.

WILMINGTON, N. C.—The Wilmington Electric-Lighting Co. contemplate enlarging their plant.

STAUNTON, VA., have enlarged their electric-lighting plant. Address John I. Long.

PINE BLUFF, ARK.—The old gas-works are being replaced by the South-western Light and Improvement Co. A number of new gas-mains will be laid.

PINE BLUFF, ARK.—An electric-light plant is contemplated.

AUGUSTA, ME.—The Kennebec Light and Heat Company have bought the franchise and works of the Augusta Gas-Light Company and will rebuild the works with new holder, etc. J. W. Averill is Manager.

BRIDGES.

BRIDGES.—The Commissioners of Montgomery County, Pa., are asking for bids for constructing the masonry of two bridges. They will receive proposals at Norristown until October 15.

TOLEDO, O.—At the last meeting of the City Council the following resolution was introduced and referred: *Resolved*, By the Common Council of Toledo, that the civil engineer be and is hereby directed to prepare suitable plans and specifications for the construction of a pile trestle bridge over Swan Creek at Hawley Street.

BRIDGE.—The Commissioners of Wood and Lucas Counties, O., will receive bids up to October 31, for labor and materials necessary for the erection of the superstructure of a bridge over the Maumee River, on the site of the present bridge at Waterville, Lucas County, O. The said bridge is to consist of five spans of 168½ feet each, and is to have a roadway 18 feet wide. Bidders are required to furnish their own plans and specifications, both for a combination and an iron bridge. Charles A. Vordtriede, Auditor Lucas County, Toledo, O.

WALTHAM, MASS., City Aldermen have adopted plans and report on a stone bridge over Charles River, placing the cost at \$30,875. M. M. Tidd, of Boston, is the engineer.

SAN PEDRO, CAL.—A \$300,000 dock or pier will be built here. Address C. Webb Howard, of San Francisco.

ST. PAUL, MINN.—Contracts for constructing the Marshall Avenue Bridge over the Mississippi River have been let as follows: For the substructure, to P. P. O'Halloran, to use Kettle River stone, \$33,136.96; for the superstructure, to the Canton Wrought-Iron Bridge Co., of Canton, O., for \$109,100.

WILLOWDALE, ONT.—Bids will be received to the 10th of October for building a steel trestle viaduct; also tenders for the masonry, abutments and piers for the same, on the creek and ravine near Toronto City Reservoir, on lot 16, con. 2 from Bay, Township of York. Address Peter S. Gibson, York Tp. Engineer.

GENEVA, N. Y.—Address George W. Bilsborrow, of the Town Board, in reference to two bridges, which it is proposed to build.

COLUMBUS, NEB.—A \$50,000 bridge will be built over Loup River. Address the City Clerk for further particulars.

BRIDGE.—See our Proposals for a reference to a bridge on the Pennsylvania Railroad.

BRIDGE.—In our Proposals will be found a reference to a bridge over Paddy's Run, Ohio.

ROME, N. Y.—The Highway Committee ask bids for constructing an iron bridge over Wood Creek.

WASHINGTON, D. C.—The Mount Vernon Bridge Co. has the contract for the manufacture and erection of the aqueduct bridge over the Potomac.

MONTGOMERY, N. Y.—The County Commissioners will build a bridge at Montgomery, N. Y.; cost, \$13,000.

ATLANTA, GEO.—A bridge will be built by the Central and East Tennessee Railway Co., at Atlanta. E. B. Thomas, Washington, D. C., General Manager.

POTTSVILLE, PA.—It is proposed to build a bridge at Washington Street.

ROME, GEO.—The Commissioners of Roads and Revenue have awarded the contract for the new iron bridge over the Etowah River on Bridge Street. The bridge will have a draw, and will cost about \$15,000.

STREET WORK AND PAVING.

MILWAUKEE.—Twelfth Street from Wells to Cedar Street, curbing, grading, etc.; Twelfth Street from Grand Avenue to Wells Street, stone curbing; Eighth Street from Locust Street to Burleigh Street, grading, graveling, curbing, planing, and paving; First Street from North Avenue to Lee Street, sidewalks to be planed; Conway Street from Kinnickinnic Avenue to Logan Avenue, grading, graveling, planing, and paving.

MOBILE, ALA.—It has been decided to do much granite street paving. Address the City Clerk at once.

CINCINNATI, O.—The contract for work on improving Crawfish Creek Road has been given by the Board of Public Affairs to Henry McErlane, at \$42,006.50.

TOLEDO, O.—The contract for paving Frazier Street has been awarded to Thomas McKenney, at \$14,695.10.

OAKLAND, CAL.—Grading, curbing, and macadamizing are ordered on Twenty-third Avenue. A. C. Henry, Clerk of Council, may be addressed.

NORRISTOWN, PA.—The Board of Trade urges the Council to pave certain streets. Address George N. Rogers.

NORFOLK, VA.—\$45,000 has been appropriated to immediate work on the paving of Granby and Holt Streets. Address the City Clerk.

CINCINNATI, O.—Grading and paving will be done on Grand and on Gleney Avenue. Address Fred. Raine, Auditor, until October 22.

LANCASTER, PA.—The Harrisburg Car Manufacturing Company has been awarded the contract at their bid for a stone-crusher for the Street Committee of Councils.

EAST ST. LOUIS.—Bids for granite paving and grading on Front Street were opened by City Council October 1, as follows: Allen & Vieths, \$46 per square for granite paving, \$2 per lineal foot for granite curbing, 80 cents per lineal foot for limestone curbing, and 55 cents per cubic yard for grading; Eyermann & Schmalz, \$49.50 per square for granite paving, \$1.60 per foot for granite curbing, \$1 per foot for limestone curbing, and 50 cents per cubic yard for grading. Niemes & Reimann, \$47.60 per square for granite paving, \$1.40 per foot for granite curbing, 80 cents per foot for limestone curbing, and \$1.25 per cubic yard for grading. This would make the total of each bidder for the work as follows: Allen & Vieths, \$104,279.60; Eyermann & Schmalz, \$111,955, and Niemes & Reimann, \$115,862. The bids were referred to a committee of five to examine and report.

EAST ST. LOUIS, ILL.—The contract for paving Front Street with granite has been given to Allen & Vieths, of St. Louis.

STEAM-HEATING, BUILDINGS, ETC.

TUSKALOOSA, ALA.—The Building Committee of the University of Alabama, of which Hon. W. G. Clarke, of Mobile, is Chairman, has awarded the following contracts: To the Union Iron Works Company, of Chattanooga, Tenn., for a complete system of water-works; to C. M. Robush, of Meridian, Miss., for two 8-room dwelling houses for professors; to F. Hubbell & Co., of Tuscaloosa, for a complete chemical laboratory 110 feet long and 70 feet wide.

AUGUSTA, GEO.—The City Council on October 3 accepted plans for a wharf and warehouse for the use of the new steamboat company, as prepared by the Council Committee. Mayor May was instructed to advertise for bids.

OAKES, DICKEY COUNTY, DAK.—A syndicate with a capital of \$100,000 has been formed to make improvements here.

ST. PAUL.—J. R. McMurran, P. T. Dwyer, and A. G. Postlethwait are interested in a new apartment house, 100x150, eight stories, to cost about \$250,000. Plans being perfected.

LOS ANGELES, CAL.—The supervisors let the contract for building the court house to O. E. Brady, of San Francisco, at \$375,000. Stone, brick and terra-cotta will be used.

TORONTO, ONT.—Plans for the court house are nearly ready for bids. Address Alderman Jones.

TOLEDO, O.—The Toledo Natural Gas Company has made a proposition to the City Council to heat the court house and jail with natural gas, at \$1,100 per annum.

PROVO, CAL.—The contract for the steel and iron work of the jail, to be built here, has been given to the Pauly Jail Building and Manufacturing Company of St. Louis.

CINCINNATI, O.—The Exposition Commissioners have refused bids on the building, and requested Architect Siter to modify plans so as to reduce cost to \$150,000.

RAILROADS, CANALS, ETC.

CAPE May, N. J.—The Electric-Railway Company will receive a franchise permitting the laying of tracks, etc.

BROCKTON, MASS.—S. G. Grover is president of the new street railway company, which will build a road on the East Side.

HELENA, ARK.—The city voted October 1 to raise by tax \$50,000 for levees. Work will be begun very soon. J. K. Klooster, U. S. Surveyor, may be addressed.

NEW YORK CITY.—The plans for the improvement of the bulkhead along the Harlem River from One Hundred and Fifty-ninth Street, under the cliff, have been approved by the Dock Department.

LOS ANGELES, CAL.—The Pomona Heights Railroad Company has been incorporated. It proposes to build a railroad from the Southern Pacific Railroad depot in Pomona to Pomona Heights addition. The directors are: H. A. Palmer, Frank Stevenson, R. S. Bassett, T. D. Holladay, and C. D. Ambrose. Capital stock, \$12,000; amount subscribed, \$11,500.

PITTSBURG, PA.—The Marshall Foundry Construction Company, of this city, have been awarded the contract for the iron roof of the Custom House at Richmond, Va., at \$8,360.21.

LOUISVILLE, KY.—Bids for furnishing stone for constructing a lock on the Wabash River, near Mt. Carmel, Ill., were opened October 1 by Major Amos Stickney, U. S. Engineers. Delivered on top of bank at site of lock:

(1) J. N. Hoag, Jr., Cincinnati, O., special stone, \$21; cut stone, dressed face, \$15; cut stone, quarry face, \$13; squared stone and backing, \$11.

(2) Salem Stone and Lime Co., Louisville, Ky.

(3) Edward Crumbo and Joseph Melcher, New Albany, Ind., \$25.10; \$16.90; \$14.60; \$11.90.

(4) Charles E. Rees, Cincinnati, O., \$20.87; \$15.87; \$12.87; \$8.87.

Delivered at railroad switch near the river at Mt. Carmel, Ill.: (1) \$19, \$13, \$11, \$9.

(2) \$20.15, \$17.65, \$16.65, \$11.40.

(3) \$22.60, \$14.40, \$12.10, \$9.40.

(4) \$19.12, \$14.12, \$11.12, \$7.12.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b, brown stone; br, brick; br st, brick store; h, dwell, brown-stone dwelling; apart house, apartment-house; ten, tenement; s, each s. owner; a, architect; b, builder; fr, frame.

NEW YORK.

N w cor Madison av and 110th st, 2 br flats and stores; cost, all, \$60,000; o, James Henderson; a, G H Schellinger.

W s Seventh av, 100 ft w of 129th st, br flat; cost, \$30,000; o, Berthi Rodding; a, Charles Baxter.

70 Willett st, br flat and store; cost, \$19,000; o, Sam Hempner; a, Fred Ebeling.

844 to 850 w 165th st, 6 fr dwells; cost, all, \$20,100; o, G P Arbogast; a, not given.

N s 39th st, 100 ft w of 6th av, 4 br offices and stores; cost, all, \$36,000; o, W De F Manica; a, D & J Jardine.

Sw cor 82d st and 4th av, br church; cost, \$30,000; o, rectors, warden and vestry of the Church of the Redeemer; a, Wm N Wood.

N s 100th st, 300 ft e of 3d av, 8 br tens and stores; cost, all, \$104,000; o, John T Glydon; a, John Brandt.

N s 114th st, 80 ft e of 8th av, br flat; cost, \$16,000; o, Anna Hauff; a, Schneider & Herter.

E s 6th av, 25 ft n of 128th st, 4 br flats and stores; cost, \$80,000; o, Susan Sullivan; a, J C Burne.

S s 170th st, 64 ft e of Washington av, 4 fr dwells; cost, all, \$10,000; o, Jacob Lahen; a, W W Gardner.

ALTERATIONS—NEW YORK.

S e cor 23d st and 10th av, br flat and stores; cost, \$10,000; o, Jacob Appell; a, G H Schellinger.

438 Pearl st, br factory; cost, \$8,000; o, Benj Lewis; a, Wm H Holmes.

603 to 607 w 36th st, br factory; cost, \$14,000; o, Henry C Dodge; a, V B Ferdon.

CHICAGO, ILL.—2587 Archer av, br store and flats; cost, \$24,000; o, M Bonfield; a, L H Heintz; b, A Dressel.

14 N Union, repair shop; cost, \$10,000; o, City of Chicago; a, Van Pelt; b, Jos Magee.

755 W Taylor, br store and flats; cost, \$10,000; o, Joe Ebner; a, P W Ruehl; b, Jno Neebe.

16-22 Bellevue pl, br flats; cost, \$45,000; o, E Watrous; a, E R Krause; b, Thos Courtney.

557-61 Dearborn av, br dwell; cost, \$30,000; o, E Watrous; a, E R Krause; b, Leo Kabell.

160-62 Sheffield av, br flats; cost, \$7,500; o, J L Diez; a, owner; b, Jno P Flick.

87-91 Third av, br warehouse; cost, \$95,000; o, Wm H Davis; a, A Moody; b, A Lanquist.

159-61 Carpenter, br flats; cost, \$7,500; o, Mrs F Rand; a, Burling & Whitehouse; b, Barney & Rodatz.

3652-58 Forest av, br dwell; cost, \$12,000; o, W R Loveland; a, T H Gault; b, Jos Maher.

318-22 37th, br dwell; cost, \$8,500; o, W R Loveland.

379 Halsted, b s flats; cost, \$7,500; o, Jno Brenock; a, T V Wadskier; b, Jno Angus.

575-77 Fulton, br flats; cost, \$9,000; o, S E Newman; a, H A Harris; b, Wood Bros.

89-95 Clinton, br and stone factory; cost, \$19,000; o, Schuttler & Hotz; a, Bauer & Hill; b, Rossler & Winkler.

477 W Division, br flats; cost, \$8,000; o, Wm Grill; a, A Wolf; b, F Hansen.

625-29 W Harrison, br storage house; cost, \$18,500; o, H J Cohn; a, E Gallauer.

97-103 Ashland av, br addnl stories; cost, \$8,000; o, S W Rawson; a, E Baumann; b, Ernschaw & Son.

444-46 Belden av, br flats; cost, \$12,000; o, Berrman Bros; a, W L Carroll.

983-85 W 12th, br flats; cost, \$12,000; o, Louis Schefer; a, P W Ruehl; b, Wm Zueldoz.

Oak st, br flats; cost, \$32,000; o, Hannah Hogg.

Ashland av, granite and br dwell; cost, \$10,000; o, Geo B Kaul; a, L B Dixon.

Wabonsia and Milwaukee avs, br and stone store; cost, \$30,000; o, Jas Walsh; a, Donnellon & Nothnagel.

Van Buren nr Robey, br store and flats; cost, \$10,000; o, Jno Holland; a, Donnellon & Nothnagel.

W Congress nr California, br apartment bldg; cost, \$10,000; o, H H Copeland and G G McSorley; a, H S Jaffray.

Hermitage av, nr York, br and stone dwells; cost, \$70,000; a, H S Jaffray.

604 Dearborn av, br and stone dwell; cost, \$17,000; o, J S Barnes; a, C W Palmer.

Ritchie pl, 9 dwells; cost, to average some \$15,000 each; o, Potter Palmer; a, C W Palmer.

Michigan av, cor Monroe st, 2-story temporary business bldg, glass and iron; o, Brooks Estate, of Boston; a, Burnham & Root.

CLEVELAND, O.—Police station on Detroit and State sts; a, Kohler & Smith; cost, \$10,000.

GRAND RAPIDS, MICH.—Hospital bldg; b, Joel Collins

GALLATIN, TENN.—Rolling mill here to cost \$15,000

PROVIDENCE, R I.—Cor Potter and Prairie avs, br and st church; cost, \$20,000; o, St. Paul M E Society; a, J S Dorsay

Eddy and Oxford, br and b s church; cost, \$25,000; o, Christ Episcopal Church; a, W R Walker & Son

15 permits for less than \$7,000

ROSELAND, ILL.—Bank and office bldg; cost, \$30,000; o, Vanderbilt estate; a, C F Warner

BUENA PARK, ILL.—Fr Church; cost, \$10,000; o, First Presby. Church; a, Burnham & Root

DULUTH—Hotel St Louis; cost, \$400,000; a, Burnham & Root

SOUTH BEND, IND.—Br and st church; cost, some \$25,000; o, First Presby. Church; a, J L Cochrane

HYDE PARK (in Rosalie Court), 8 fr dwells; cost, \$40,000; o, Chandler & Co.; a, R Rae Jr

MORGAN PARK, ILL.—Br and granite Blake Hall; cost, \$30,000; o, Baptist Theological Seminary; a, S M Randolph

PHILADELPHIA.—No large buildings to report this week.

HARRISBURG, PA.—Nothing to report this week over \$7,000 in value.

WORCESTER.—Salisbury, private fr dwell and stable; cost, \$10,000; o, B W Potter; a, Barker & Nourse; b, A Palmer.

Cedar, fr double cottage; cost, \$6,000; o, F W Ward; a, Barker & Nourse; b, George Kingston.

HURLEY, WIS.—Mr A C Clas, architect, Milwaukee, has completed plans for a block of stores to cost \$20,000 for Mr. Richards.

MONROE, WIS.—Mr A C Clas, architect, Milwaukee, has prepared plans for a residence to cost \$8,000 for J. Steinman.

SAN DIEGO, CAL.—A hospital will be built in the public park. Address George J Keating or the City Clerk.

COLLEGE POINT, L. I.—Fire-engine house; cost, \$45,000. Address Village Trustees.

MONTCLAIR, N. J.—Club-house proposed on the Love property; cost of house, \$25,000.

WINONA, MINN.—In progress, County Court-House.

RICHMOND, VA.—Keepers' lodge; o, St John's Cemetery. W G Cutshaw, City Engineer.

PROVIDENCE, R. I.—Christ Episcopal Church in South Providence; a, W R Walker & Son; contracts not yet let.

In progress St Paul's Methodist Episcopal Church; a, J S D'Orsay, of New York

BALTIMORE, MD.—Washington st Methodist Church, cor Chester and Lombard sts; a, T Buckler Ghequier.

POMONA, CAL.—Proposed Congregational College bldg.

BALTIMORE, MD.—Pratt st, rebuilding Mason & Co.'s bakery; b, George Rausch.

LOS ANGELES, CAL.—Address C A Day in regard to large hotel to be built by the St Vincent Co.

MARIANNA, FLA.—A hotel will be built here; contract let.

CAMDEN, N. J.—Bldg cor Broadway and Chestnut st.

MILLBURY, MASS.—Unitarian church, br; a, E Boyden & Son.

TORONTO, ONT.—Br and st church, for Spadina Methodist congregation (Spadina ave. and College st); a, G. J. Lennox.

SOUTH OMAHA, NEB.—Alt to Stock Exchange bld; plans ready.

KEOKUK, IOWA.—A new municipal building will be built here.

BALTIMORE, MD.—A crematory to cost \$21,000 will be built here.

CEDAR RAPIDS, IOWA.—A Young Men's Christian Association building, to cost over \$20,000, will shortly be erected here.

BETHLEHEM, PA.—New school house; cost, \$16,000; b, Bishop & Fatzinger. Address Edwin G. Close, Chairman of Board of Education.

WASHINGTON, D. C.—Frank N. Carver has the contract for the erection of an office building, to cost \$140,000.

ALLEGHENY, PA.—Sandusky st.; four br ten; press br fronts; st trimmings; tin roof; cost, \$20,000; o, J. Haworth; a, Thos. Boyd; b, S. Hastings.

PASO DEL NORTE, TEX., is to have a Custom House; cost, \$240,000. George A King, of El Paso, is the architect.

DENVER, COL.—A building is to be erected by the Masonic Society; cost, \$100,000.

KANSAS CITY, MO.—The Cavalry Baptist Church will erect a new \$100,000 building.

BETHLEHEM, PA.—In progress, Holy Trinity Lutheran Church in West Bethlehem.

NORTH GRAFTON, MASS.—Brick block for Washington Emory Mills; o, Mr Crocker.

DENVER, COL.—Plans are making for the new Wolfe Hall. It will cost \$100,000.

DENVER, COL.—Cheever Block, on Lawrence st; o, C G Cheever; a, F E Edbrooke & Co; cost, \$60,000.

LA HARPE, ILL.—Mill building proposed; o, La Harpe Milling Co (J G Figley and others).

BROOKLYN.—Secretary Fairchild has approved the plans for the Post-Office, as prepared by Supervising Architect Freret.

WASHINGTON, D C.—The estimates of the District Commissioners provide for erecting 6 school houses. Address Colonel William Ludlow

DULUTH, MINN.—Alteration to city Lock-up on Michigan st; address Guy Wells, President of Board of Public Works.

BOSTON.—36-46 Chambers st, brick church and parish house; cost, \$40,000; o, Trinity Church; a, Allen & Kinnaz; b, Whidden, Hill & Co.

Gardner st, Brighton, wooden dwell; cost, \$12,000; o, Emma F Woodbury; a, F E Kidder; b, Woodbury & Leighton.

Middlesex st, br dwell; cost, \$8,000; o, James H T Adams.

Ordway pl and Province court, br hotel 8 stories; cost, \$120,000; o, Daniel L Denon; a, Webster, Dixon & Co; b, S J F Mayer.

NEW HAVEN, CONN.—Howard av and Lamberton st, br chapel; cost, \$7,000; b, G M Grant.

Cor Wallace and Wooster sts, br factory; cost, \$11,000; o, W Schollharm & Co; a, Robinson; b, Bates & Townsend.

Grove st near Church, 2 br dwells; cost, \$20,000; o, Chas H Webb; a, D R Brown; b, L V Treat & Sons.

Park st near Chapel, brick dwell; cost, \$8,000; o, J H Platt; b, A D Baldwin & Son.

Whalley av, br dwell; cost, \$12,000; o, E Larkins.

York st near Elm, br dwell; cost, \$17,000; o and b, E H Sperry.

MENASHA, WIS.—Woolen mill; cost, \$75,000.

JERSEY CITY, N. J.—Br church for James Methodist congregation in Charles st; cost, \$12,000.

NEW ORLEANS, LA.—Alteration Jewish Home on Jackson st.

OMAHA, NEB.—20th and Davenport sts, First Methodist Church; cost, \$100,000; b, H D Fitch.

LEROY, KAN.—A \$150,000 sewing machine factory will be built here.

GENEVA, N. Y.—No buildings over \$7,000 in value.

SANTA FE, CAL.—3-story br hotel, just finished ready for furnishing; cost, \$48,000; o, Santa Fe Hotel Co.

BROOKINGS, DAK.—Company G will build an armory.

WINONA, MINN.—Youmans Bros. & Hodgins will build a new saw-mill, 200x81.

MILWAUKEE.—\$8,000 has been appropriated for an addition to the 8th district primary school.

The committee on public buildings will make arrangements to erect a building for the insane persons of this county, as the present asylum is too small.

507 Astor st, alter; cost, \$5,000; o, C D Nash; b, R W Williams

E T Mix & Co., architects, report an \$8,000 school at Waukesha, Wis. E. S. Howe is the carpenter

The architects report operations in buildings quiet
12 bldgs under \$7,000.

ST. LOUIS, MO.—Ohio av and Victor st, br factory; cost, \$7,000; o, G C Fox; b, sublet

9th and Chontean av, br store and dwell; cost, \$11,000; o, H C Meyer; a, H Pipers; b, C Wehking

Texas and Potomac avs, 7 adj. br dwells; cost, \$10,000; o, C N Dolph; b, J Noecker

14th and Emily sts, br school; cost, \$10,000; o, St. Louis Pub. School; a, H A Kirchner

ST. PAUL.—Robert, nr Plate, 3-story brick factory; cost, \$14,000; o, De Coster & Clark

Woodward, nr Bradley, 1-story br dwell; cost, \$8,000; o, E F Krahmer

George, nr Carlton, 2-story br dwell; cost, \$32,000; o, S Deering

Park, nr University, 2-story fr dwell; cost, \$8,000; o, P O'Reagan

99 minor permits, \$62,000

THE ENGINEERING & BUILDING RECORD

AND THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 20. } PUBLISHED EVERY SATURDAY.

NEW YORK, OCTOBER 15, 1887.

LONDON, OCTOBER 29, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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THE KOUTS CAR-STOVE CREMATION.

THE mortality attending the railroad collision this week on the Chicago and Atlantic Railroad near Kouts, Indiana, in which some 12 people lost their lives, was mainly due to two causes: First, the car-stove and the method of lighting; and secondly, the flimsy construction of some of the cars that were crushed to kindling wood between their heavier neighbors, which were comparatively uninjured. If this continued cremation must go on for another winter, it is fortunate that so early in the season the public should have another warning that will direct their attention to the inaction of the railway authorities, who, with very few exceptions, so far as we are informed, have done nothing yet to meet the just demands of the public and obey the laws enacted in several States looking to the removal of the car-stove and the introduction of heat from an outside source. About eight months have elapsed since legislation required companies in certain States to abandon the present dangerous method of heating and lighting cars. A few companies have striven honestly to introduce methods which are not monopolized by any one patentee, but which are available and within the means of any company which is willing to pay a reasonable price for them, subject only to such embarrassments as are involved in any important change. We regret to say, however, that there is too much evidence that railway companies are unwilling to incur the expense of perfecting such details as only actual use will demonstrate to be desirable, preferring to wait for other companies more public-spirited to make these experiments, and apparently indicating in the meantime a disposition, if the car-stove is abolished, to give their passengers the alternative of being frozen.

Buddensieck was sent to State's Prison for having buildings put up under his direction which were so constructed that they fell down and killed somebody. In view of the state of the art in the matter of heating at this day, and the ability to heat cars from an outside source, there is no reason why the directors of our railroad companies should not be in a like manner punished if any lives are lost another year on the cars of their roads by reason of fire resulting from the present car-stove.

In a subsequent issue we hope to indicate what has been done and by what roads. Those who have been remiss in meeting a just public demand that they are entirely capable of fulfilling, may yet succeed in arousing public indignation to such a pitch that the next law enacted will make it homicide for the officers and directors of any road on which such casualties occur when it is proven that they have failed to provide their roads with such safeguards as every expert now knows is available.

STARVATION DROPSY.

It is not often within the United States that the effects of slow starvation upon a number of persons can be observed, but an opportunity of seeing this has recently been afforded by the parish prison of New Orleans, and the report of the investigation made of this place by Dr. W. H. Watkins, a sanitary inspector of the State Board of Health, reveals a condition of things which is very remarkable as occurring in a civilized country in time of peace. Attention was attracted to this prison by the occurrence of a number of

cases of acute dropsical swelling of the legs, arms, face, and body among the 300 prisoners confined in it. From Dr. Watkins' report it appears that each prisoner is allowed a piece of bread and a pint of tea early in the morning, and one meal consisting of soup, the beef cooked in the soup, and bread. The beef is furnished by contract at 5½ cents per pound, and it has several times been condemned by the resident surgeon. Dr. Watkins concludes that the disease is due to confinement, with insufficient and unwholesome food, and that the remedy is to furnish a more liberal diet of better meat and fresh vegetables. It might be supposed that some one was to blame for such a condition of things, but the report gives no hint on this point.

HOLBROOK HALL.

THE threatened disaster at Holbrook Hall, illustrated and described in another column, affords a very valuable and, we fear, much-needed lesson on the danger of excluding air from structural timbers, especially if not perfectly seasoned. Whether hemlock, the timber at fault in this instance, is more liable than other wood to decay under such circumstances, it is perhaps too soon to say, though the better experience with spruce would seem to indicate the superiority of the latter.

FORESTRY CULTIVATION.

It is with a feeling of lively satisfaction we note the fact that our Government is at last awakening to the necessity of a positive and energetic control of the forests of the country. The loss of the wood, which has been so ruthlessly cleared away, is the least of the evils. The scarred and barren mountain-sides, the increase of devastating freshets, the destruction of many thousands of acres of alluvial lands along our water-courses, and severe local changes in climate, are all evils flowing from this same source, and the lands thus devastated are absolutely irreplaceable in their former adaptability to the uses of man.

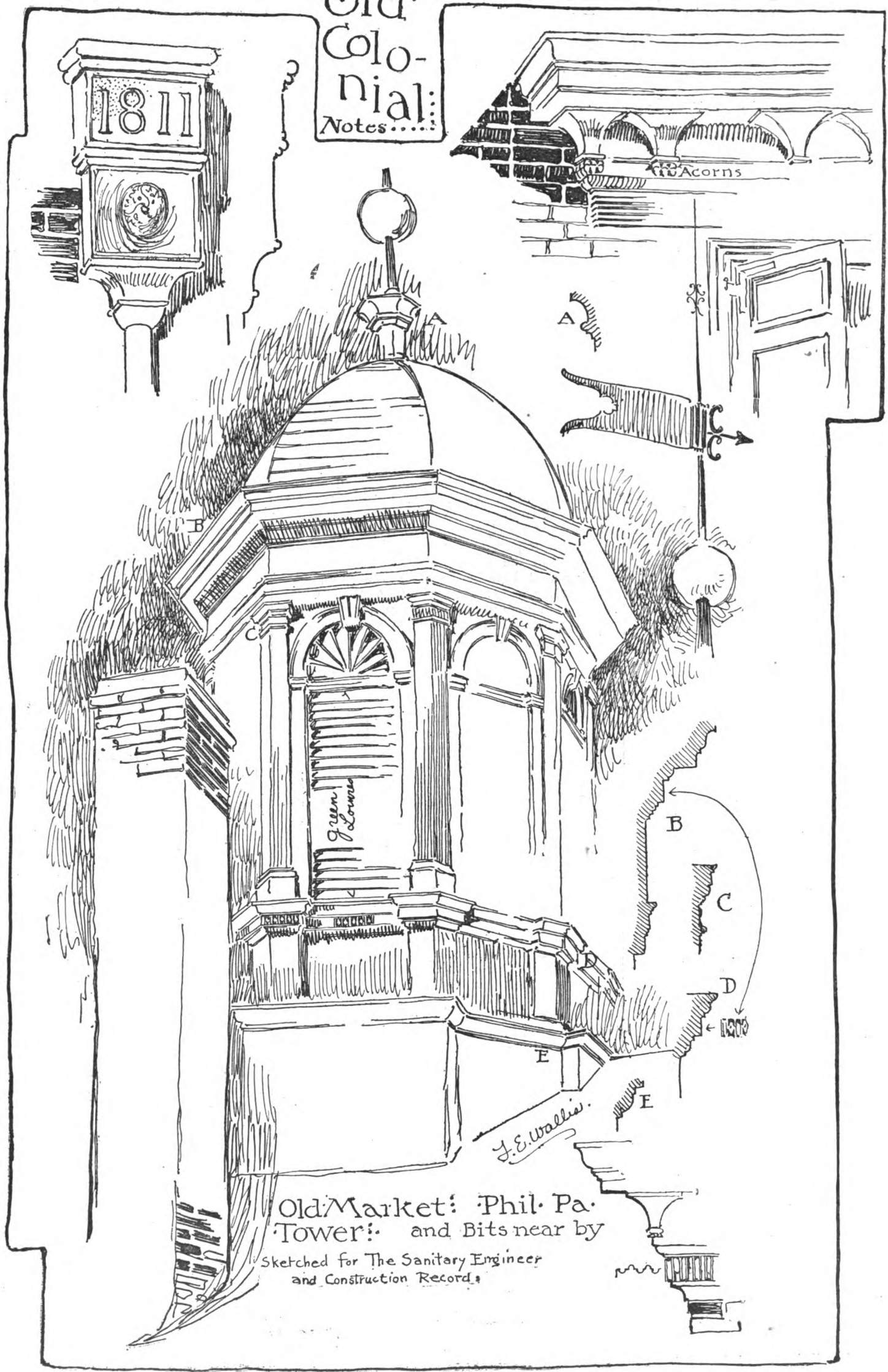
The woods may be restored after fifty to one hundred years where the soil remains, but the leaf-mold, and soil, which have been of many centuries' growth, are gone from many a mountain or hill, where formerly it supported and was kept in place by a beautiful forest.

So complete has been the destruction of trees along some of the cañons and passes in the Rocky Mountains for example, that a traveler would think the region treeless, were it not for stumps which yet remain. The effect of this is seen in an increasing deficiency of water in the streams during summer, so that the question of water-supply to the rapidly-growing towns in the region is a serious one. Nature's reservoirs—the sponge of the leaves, and mosses, and the rootlets of the trees—are destroyed, and it is now proposed to establish great artificial reservoirs, at enormous expense, to make up for the loss.

About a year ago the Assistant Secretary of State sent a circular to all consular officers asking them to obtain information upon all questions bearing on forest planting and culture, forest control, revenues, timber-supply, laws and regulations, etc. The reports received are now published in a pamphlet which is full of interesting matter.

Taking, for example, "Austria-Hungary," the laws are now so rigid that if enforced not a tree

Old Colonial Notes.....



Old Market: Phil. Pa. Tower: and Bits near by

Sketched for The Sanitary Engineer and Construction Record.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

RESIDENCE OF W. D. SLOANE, ESQ., LENOX, MASS.

PEABODY & STEARNS, ARCHITECTS.

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34

can be cut even by a private owner "except in accordance with certain rules and restrictions."

The total number of forestry officers of all grades is 31,286, and each one must be specially educated for the position he holds, from the "chief forest counsellors" (*oberforstrathe*) to the lowest forest ward, with a salary of a little over \$100 per year. The profits of forest culture have largely increased during the last fifty years.

There are three grades of schools—university, middle, and elementary. In all of them a study of the causes of decay and destruction are important elements in the courses pursued. It cannot be questioned that with the destruction of insectivorous birds which is constantly going on there is increasing danger to the forests.

To show that we have not written too strongly respecting the fearful consequences of the indiscriminate destruction of great areas of woodland, we quote a passage from this report:

The causes of the destruction of forests have been the same in the Old World as in the New.

The greed of men, the desire of speedy gain without reference to consequences, the want of judgment and knowledge as to cause and effect in the courses of nature and its developments, have razed and shorn the forests along the spurs of the Alps and the shores of the Mediterranean with the same merciless energy which has been displayed in this direction along the shores of American rivers and on the slopes of American mountains.

A great area of the shore provinces of this Empire is now almost an arid desert. There is little timber in Dalmatia and Istria and in the territory near Trieste.

The dearth of timber and wooded slopes is so pronounced that the region has been denominated by a particular name "The Karst," which in its common acceptation is almost synonymous with "Sahara."

There was a time, though not within the memory of men now living, when all this region was covered with a dense oak forest.

Already in the year 452 before Christ these woods furnished the material for Roman castles, houses, and ships.

Venice, while in her pride and glory as queen of the seas, also drew her supply for ship-building and pile foundations from this source, and what was left was purchased and chopped down by the merchants of Holland and England.

When the timber was all cut down and nothing left but the roots there was still hope that a new forest would have grown up out of the bare ground during the course of centuries, but then the native inhabitants stepped in and took possession and by pasturing their sheep and goats upon the treeless plains and hillsides made all growth from the roots impossible, and they even dug up the roots for firewood, and thus made a very clean and thorough job of this barbarous devastation.

The result in a climatic direction has, as a matter of course, been highly disastrous. The same region which had been famous for its mild and temperate climate has become changeable and unreliable, landslides and avalanches have come and gone their unobstructed way, the mountain creeks have become dry, and the whole face of the country has been changed from a rich, fruitful, and salubrious climate to an arid, sterile plain, interspersed with stony and parched hillsides, populated by meagre sheep and goats and their equally meagre owners.

Austria is now trying to reclaim these wastes by tree-planting but the work is slow and expensive.

One of the forest laws makes it the duty of the owners of forest land to report insect ravages, in case they cannot control them, under heavy penalty for not so doing.

The Consul at Marseilles is equally positive as to the great loss South-eastern France has suffered through forest destruction. After giving the process causing the disastrous result, he states that about one-fourth of the whole region has been rendered totally unfit for cultivation. The process of reclamation has in 19 years cost the State nearly \$10,000,000, and 250,000 acres of land have been reclaimed.

The laws in France carefully regulate the felling of trees on slopes and points where the land, if denuded, is subject to wash by rains.

Much has been done to reclaim the sand-dunes by "first building palisades parallel to the sea

and then sowing the dunes with the maritime pine mixed with the seed of the furze and brush-broom." The forests thus raised have become sources of wealth, and the dunes made safe against encroachments from the sea.

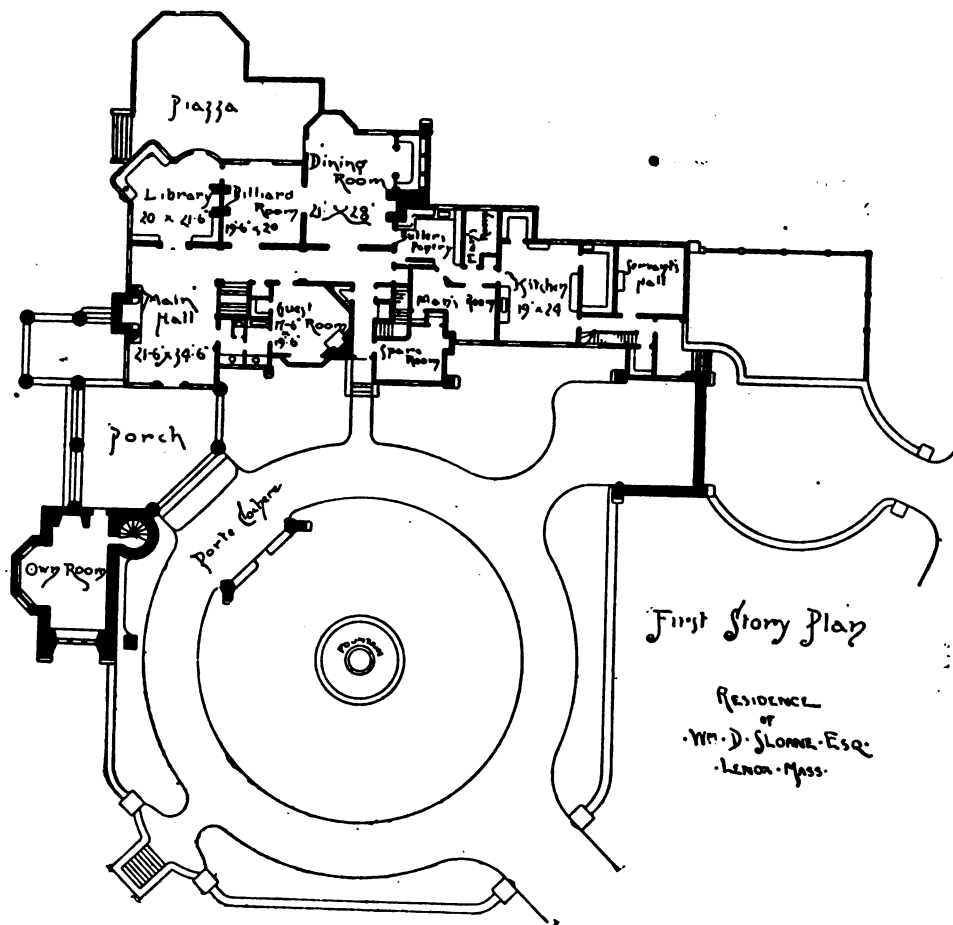
One of the interesting matters in the report is a description of the method taken to overcome an outbreak of insects, the common bark-beetle, in 1873-4. After an extensive series of windfalls caused by a violent storm the insects bred in great numbers in the fallen branches. One of the means employed was to use "decoy trees," which were felled and placed in sunny spots to catch the swarms when about to lay their eggs. The bark

OUR ARCHITECTURAL ILLUSTRATIONS.

RESIDENCE OF W. D. SLOANE, ESQ.

THE country residence of W. D. Sloane, Esq., at Lenox, Mass. The foundations, piers, etc., are of white marble from the local quarries; stained shingles for walls and roof. Interior: dining-room, quartered oak; library, cherry; elsewhere pine, painted. The marble used was the cheapest good local stone and was used for that reason rather than for show. The architects were Peabody & Stearns, of Boston.

OLD MARKET TOWER, PHILADELPHIA, PA., AND BITS NEAR BY.



was then stripped off, thus destroying the larvæ. The volume is full of interesting matter, but we can do no more than indicate its character and call attention of our readers to it.

THE VALUE OF HEALTH BOARDS.

(From Milwaukee Evening Wisconsin.)

TWENTY years ago the arrival of a cholera-infected ship like the one now in quarantine in lower New York Bay would have created a panic in the metropolis and aroused great forebodings throughout the country.

Now, the arrival of the death-laden vessel is noted and discussed by the newspapers as any other important piece of news might be, but there is no scare in New York, no getting away or staying away from the city, and no unusual anxiety anywhere.

The explanation of the differing deportment of the people then and now is found in the fact that the present Health Department of New York is so admirably organized and possessed of such proved efficiency in stamping out contagion, that it is confidently relied upon to prevent the dread disease from landing.

All that money and professional skill can secure and suggest are at the service of the New York health authorities. And so prompt and efficient has been their action that the Government at Washington has been notified by Government officials that there is no need of interference; the New York board is abundantly competent to do all that is required.

That Health Department probably costs New York a few score thousand dollars per year. Yet, because it is so efficient that the people have absolute confidence in it, there has been saved to New York alone within the last week, hundreds of thousands of dollars which would have been lost had even a partial panic possessed the people and so interrupted and injured trade.

What is thus true of New York is equally true of Milwaukee and Wisconsin. Quite aside from all considerations of comfort and happiness and humanity, the actual commercial value of wise appropriations for the efficient maintenance of our city and State health departments is beyond calculation.

PAVEMENTS FROM BLAST-FURNACE SLAG.

IN the Hanover district of Germany the blast-furnaces make a specialty of a road-metalling material called slag-stone. For its preparation the slag as tapped from the furnace is run into a bottomless cast-iron mold which is tapering to the top and stands on an iron truck. After the slag has cooled enough to have an outer shell sufficiently strong to support the melted mass inside the mold is lifted off and placed on another truck ready for use, while the loaded truck is run off to the dump-heap, where the truncated cone is pierced and the slag run onto the ground and covered with cinders and ashes and allowed to cool very slowly. This makes the slag much tougher than when allowed to cool in the open air, and it is said to wear very well when broken properly and placed on roads.

The ordinary brittle slag makes a very good foundation for a road, particularly on clay and wet soils, as by rolling, the top pieces form a powder that fills the interstices between the lower fragments so thoroughly that neither clay nor mud can work up through the layer, and on this the more durable wearing layers can be placed. It was found impossible to form any roads on the soft clay surface of the Centennial Fair Grounds at Philadelphia, until their beds had been prepared by a layer of well-rolled furnace-slag, after which they stood very heavy teaming without underdraining; the bonding of the fragments of slag with the thorough filling of the interstices preventing any mud from working through the first or lower layer thus keeping the road from breaking up.

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HISTORY OF THE DEVELOPMENT OF THE ART OF BRIDGE CONSTRUCTION.

BY PROF. W. P. TROWBRIDGE.

HAVING delivered an address before the New York Academy of Sciences on the "History of the Development of the Art of Bridge Construction," I have, at the request of the Editor of THE ENGINEERING & BUILDING RECORD, prepared from my notes the matter for publication in that journal, he having had made, from photographs in my possession, the drawings used to illustrate the article. No attempt was made to describe or demonstrate details of construction, but rather to trace the development of an art which has been, in all ages, to a certain extent, not only a sort of index or gauge of intellectual advancement

the arts are fostered, the bridge, in beauty of design and workmanship, is often the most significant expression, not only of the skill and genius of a people, but of their refinement and taste.

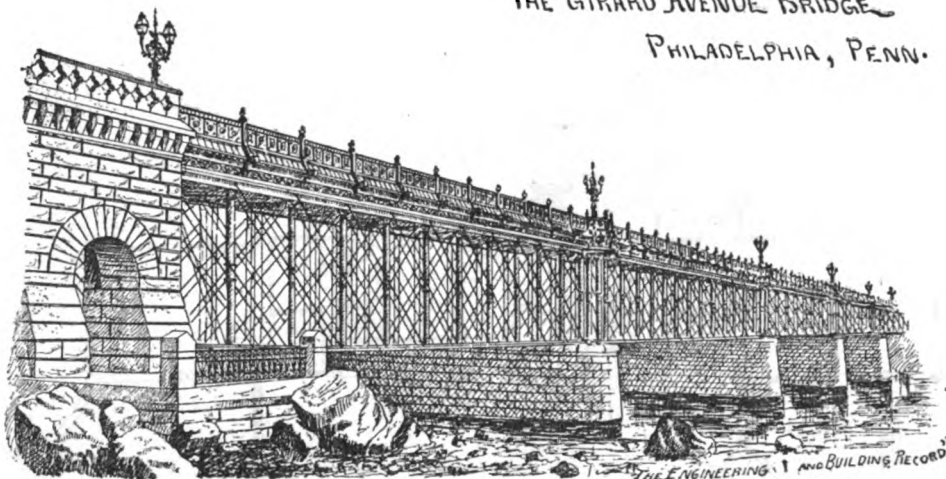
It is unfortunate in this latter respect that the necessities of railway traffic in modern times have caused the introduction of forms and modes of construction in iron, scattered everywhere throughout civilized countries, which mar the most delightful landscapes, and which contain no lines of grace perceptible to any one, except the engineer who may claim to find beauty in every structure which fulfills its objects. He only knows how much of intellectual labor the uncouth skeletons which carry our railway trains safely across the widest chasms have cost in the

which are now met with at every turn, and which are constantly being multiplied, simple architectural adjuncts to relieve their uncouth appearances. In one instance, at least, this has been done in this country with marked effect, though the conditions under which the structure was built were certainly unusually favorable in this respect. I allude to the Girard Avenue bridge in Philadelphia, designed and built by the Phoenix Bridge Company, a wrought-iron bridge, which has called forth from many a traveler from foreign lands expressions of delight on account of the architectural elegance of its design. (See cut.)

The history of the development of the art of bridge construction is marked, to a certain extent, by periods or eras coincident either with the introduction of new materials in the arts, or with the necessities which have arisen for compassing greater spans under conditions of heavier traffic. The suspension bridge, of very ancient origin, has held its place, though to a limited extent, until our own time, when its place is likely to be usurped, to a great degree, by the cantilever. Built in primitive times, with cables of organic material, the introduction of wrought iron and of iron wire furnished facilities of construction and elements of durability and strength which the older suspension bridges did not possess, and the great bridge between this city and Brooklyn may be regarded as the culmination of this system, and perhaps the most remarkable example which the world is destined to see; there being inherent defects of the system, which render it inapplicable to rapidly moving heavy loads, which will always be a sort of bar to its general use.

The reverse of the suspension bridge, the arch, of all systems has held the most universal sway until the long spans met with in the routes of railway communication, and the difficulties of establishing numerous piers in swift currents and on treacherous foundations brought about, first, the long-span timber bridge, and subsequently, the modern structures in wrought iron, which have become so common in our times. The history of the arch in bridge construction extends from a period farther back than the beginning of the Christian era to the present day; but the days when great engineers like Perronet, Nimmo, Telford, Rennie, and others could acquire fame by building chaste and beautiful arch bridges of stone masonry seem, unfortunately, to have passed.

One of the largest and most picturesque structures of this kind in the world, unsurpassed in many respects by the most famous arches of history, constitutes a part of the Potomac Aqueduct, near the city of Washington. This magnificent structure, called the Cabin John Bridge (see cut), erected by General M. C. Meigs, of the U. S. Army, will probably remain the most conspicuous memo-



THE GIRARD AVENUE BRIDGE
PHILADELPHIA, PENN.

and material progress, but also of wealth, taste, and refinement.

It is sometimes interesting and instructive to go back to the earliest times and follow up historical records and examples connected with any art, if for no other purpose than to compare our modern works with those of older date, even though we find little to be copied or reproduced of all that has gone before.

In works of engineering generally, unlike those connected with the fine arts, there is little to be learned from the ancients. We are surrounded on all sides by structures of a purely engineering character, which could only have been devised and executed in modern times, and for which antique models do not exist. There are certain elements, however, of these structures which belong to all ages, since they are but the practical applications of simple mechanical laws in which boldness of conception and design, simplicity and taste in construction, and perfect adaptability to their uses and objects, exhibit the intellectual condition of the people by whom such structures have been erected.

It may be said that properly constructed lines of land travel are both causes and effects of civilization. The common road and the railway, pushing out beyond the boundaries of populous districts or penetrating uninhabited wildernesses, are sure to be followed by an advancing tide of emigration, while the introduction and maintenance of thoroughfares more complete and permanent in their construction than was at first practicable is an indication of increasing thrift, culture, and refinement on the part of the people.

The famous engineer, Telford, who constructed many hundred miles of good turnpike roads in England and Scotland under special acts of Parliament, expressed the opinion or belief that these roads had advanced the communities of the districts through which they passed one hundred years in civilization.

The construction of a line of land travel involves, of course, numerous bridges, rude and cheap in primitive times, but exhibiting elements of a more permanent character and more pleasing architectural features as a country advances in wealth and education. There are few architectural structures which more truly indicate intellectual cultivation and general prosperity than the bridges found along the lines of intercommunication.

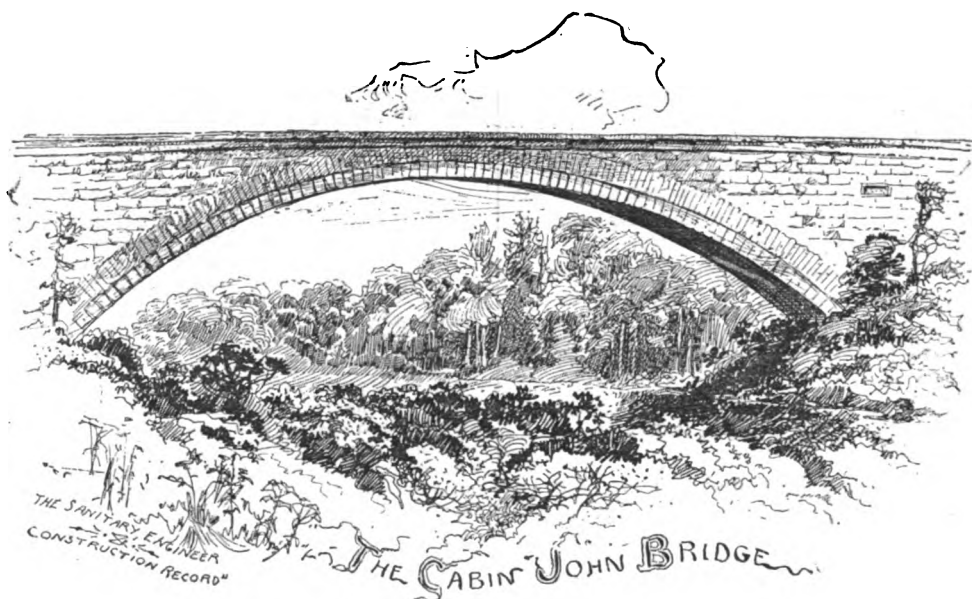
It is certainly true in our own day that a district in which streams are crossed only by fording is either sparsely populated, or else occupied by ignorant, unthrifty, and improvident communities. The energy, the talent, the means of surmounting material obstacles, are in such cases wholly or partially wanting, while, on the other hand, where wealth is accumulated and science and

efforts that have been required to design and adapt them to their uses.

An English writer on the subject of bridges in discussing, forty years ago, the designs of American timber bridges, although compelled to give them the pre-eminence, applied to them the remarkable criticism (because they were boxed in or covered on the sides and top to preserve them from decay), that they "looked like coffins for sea-serpents."

If this curious criticism be in any way applicable, it might be said now that the coffin has been removed and the skeleton, transmuted into iron, exposed fully to view.

It would appear to be not only difficult, but, in the eyes of many, a violation of constructive art to attempt to give the same pleasing appearances to most modern systems



of iron bridges that are easily and naturally embodied in bridges of stone; and although the present is the age of iron, yet it is to be hoped that the stone bridge, once the pride of the great engineers of history, may not be given up and forgotten, but that it may be reintroduced, whenever circumstance may allow, in order that it may again add beauty to our landscapes, even in rural districts and outside of the limits of ornamented parks and pleasure-grounds, to which it has in modern times been mostly confined.

It should not, however, I think, be considered impossible to add to the skeleton structures in wrought iron,

rial in this country of a system which, for highways and railways, is gradually being replaced by iron.

Cast-iron arch bridges were first introduced a little over one hundred years ago in England, and for a time met with marked public favor. The facility with which cast iron lends itself to the introduction of minor decorations in forms and moldings enabled bridge architects to present a great variety of pleasing designs, and numerous bridges were constructed about the beginning of this century which attracted much attention. It has been claimed that Thomas Paine, whose name has been preserved in history only through his atheistical writings and doctrines,

was the inventor of the cast-iron arch bridge. This claim is, however, not well founded, inasmuch as this kind of bridge was already in use in England before Paine sailed from America with the object of carrying his plans abroad, where he thought they might be favorably considered.

The cast-iron bridge had, however, but a brief historical record. The want of sufficient elasticity, the imperfection of castings, and the liability to rupture under sudden strains or blows has caused cast iron to be thrown out of the catalogue of available materials for the principal elements of bridges of any considerable importance.



SCHAFFHAUSEN TIMBER BRIDGE OVER THE RHINE

Of timber bridges it may also be said that they have had their day and have fulfilled their temporary uses. When railways were first introduced about the end of the first quarter of the present century, the necessity of providing bridges along their routes of longer span and cheaper construction than could be furnished in stone led to a more critical study in the use of timber for bridges than had ever before been bestowed on the subject. Previous to this, however, many noted bridges had been built, which were masterpieces of work in timber, and which have preserved to history a few names which will always be remembered in connection with the noble art of carpentry; an art now, for various reasons, in its decline. Among these names that of Ulrich Gruebenmann, who built the famous bridge over the Rhine at Schaffhausen toward the end of the last century, and the name of Timothy Palmer, of Newburyport, Mass., will always be prominent. The timber highway bridges of the latter in this country were models of scientific, practical, and mechanical workmanship. The Schaffhausen bridge stood alone as a great work, in which the inherent principle of construction was the arch, combined with the elements of the common roof, but it brought into use no new principle, and had no elements which might cause it to be reproduced or copied.

Another name destined to a more substantial and enduring fame in connection with timber bridges is that of Ithiel Towne, for many years before his death an architect

people of New Haven who know its history is the chief object of interest in this particular spot. Few persons, however, are aware of the fact that the mechanical design of this bridge was the first departure from the principle of the arch and the suspension principle ever attempted; and that it is, although constructed entirely of timber, without a nail or a spike except those used in the board covering, the prototype of nearly all modern constructions in iron which have of late years become so numerous, and which are classified as braced girders. This bridge was devised and erected by Ithiel Towne, about the year 1823, for the

New Haven and Hartford Turnpike Company, across the Mill River. It is 100 feet long, fourteen feet wide, and twelve feet high, and is built on the principle of straight top and bottom chords, connected by diagonal bracing; a



PONT DU GARD BRIDGE - FRANCE

principle invented by Mr. Towne and never before introduced into bridge construction.

About the year 1840, Mr. Eli Whitney, of New Haven, who was then constructing the dam and reservoir on Mill River, which now supplies New Haven with water, removed this bridge bodily on skids from the point where

was the employment of an entirely new principle in bridge construction, which, by a mere change from timber to wrought iron and steel, has been followed ever since. Details have changed, the modifications giving rise to various types as they are known at the present day, but the fundamental principle has been almost universally adopted in all countries, and remains unaltered.

The tubular bridge, a later design, of which the famous Menai Bridge, erected by Stevenson and Fairbairn across the Menai Straits, is the most conspicuous example, has had no important development, skeleton structures being now universally preferred.

The latest advance in what some would prefer to call the "evolution" of the bridge, is the cantilever system. Though designs were made, and the system strongly urged upon the engineering profession of this country nearly twenty years ago, for spans exceeding the possible limits of the straight girder,* yet it was not until Mr. C. C. Schneider designed, and the Central Bridge-Works, of Buffalo, constructed, under his supervision, the Niagara Cantilever Bridge, that the merits of this system for very long spans became fully appreciated.

The system has spread with great rapidity since the Niagara Cantilever Bridge was completed, the Forth



TOWNE LATTICE BRIDGE

of New Haven, Conn. Two or three miles out from New Haven there is a covered bridge spanning a narrow part of Lake Whitney, which, in connection with the subject which we are discussing, has an interesting history. This bridge, a sketch of which, recently made by myself, is shown above under the name of the Towne Lattice Bridge, although presenting in itself no artistic feature, being entirely covered in, and being, in fact, the first of the bridges which on this account was sneered at by the eminent English writer referred to as looking like "a coffin for a sea-serpent," is nevertheless the central feature of a limited but charming little landscape, and to the

it was first erected to the place it now occupies, about half a mile distant—a difficult feat of engineering, but accomplished without removing or displacing a single timber of the bridge. The bridge is thus probably the oldest timber bridge of any considerable span in this or any other country, having fortunately escaped the fate of nearly all large timber bridges—destruction by fire.

The principal parts have never been renewed, and, thanks to the board covering, these parts are still sound and serviceable.

I have dwelt at some length on the history of this particular bridge, because the interesting feature of its construction

Bridge now being erected in Scotland on this principle and destined for railway traffic having the extraordinary span of seventeen hundred feet, a greater length than that of the New York Suspension Bridge.

A cursory glance at the development of the art of bridge construction thus reveals a series of interesting facts:

First—That masonry arch-bridges, from their simplicity, elegance, permanence, and strength, have in all ages been the most favored forms of construction for highways, and that the use of iron and steel has in no way changed this popular favor, except where the employment of these materials is either favorable to economy or to the introduction of larger spans. For railway-bridges, other considerations favor also the use of iron and steel over the use of stone.

Second—The introduction of cast-iron arches, though favorable to architectural elegance of design, has not resulted in any permanent useful developments.

Third—Timber bridges have in all ages been regarded as temporary structures which were to be replaced sooner or later by others more permanent in character.

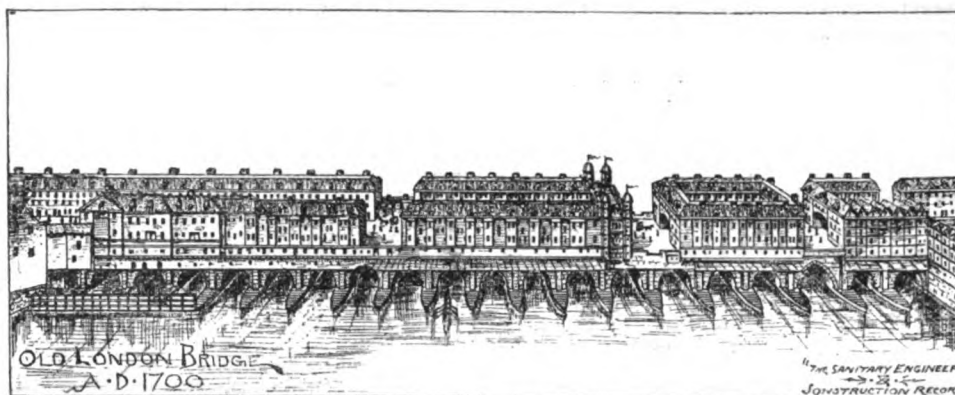
Fourth—The springing up and immense development of the railway systems of the world within the last sixty years, and the concurrent progress made in the metallurgy of iron and steel, have given rise to entirely new problems in bridge building and to a new branch of the engineering profession.

Fifth—The demands of railway traffic for direct lines which must surmount every obstacle either by tunnels or bridges, the heavy weights transported, and the great speed of trains required, have diverted, for a time, public interest from the highway; formerly, in the time of the old stage-coach, the source of many peculiar delights to the traveler.

* Mr. C. C. Schneider, the designer of the Niagara Cantilever Bridge, asserted, at the time of the delivery of the address, that the design of the bridge over Blackwell's Island, here illustrated, was the first cantilever design proposed for this bridge by Professor Trowbridge nearly twenty years ago, and that this design was, to his knowledge, the first one in which the cantilever principle was applied to a long span and properly taken advantage of for the purpose of facilitating erection without obstructing navigation.—Ed.

We are now rattled over bridges and whirled through tunnels at a speed which precludes more than an unsatisfactory glimpse of the scenery which seems to flit by us; comfort, safety, and speed fill the measure of our expectations. But the change has caused our highways to be neglected, and even in the great thoroughfares which lead out from our cities and towns the iron bridge seems to have driven out the more beautiful and durable structures in stone, which ought here, at least, to occupy their proper places. There is no internal improvement more imperatively demanded in this country at the present time than systematic reconstruction and maintenance of our highways.

Viewed as intellectual and mechanical achievements, however, the great bridges of modern times are to be classed with steamships, locomotives, and pumping-engines, which could not have been suggested a hundred



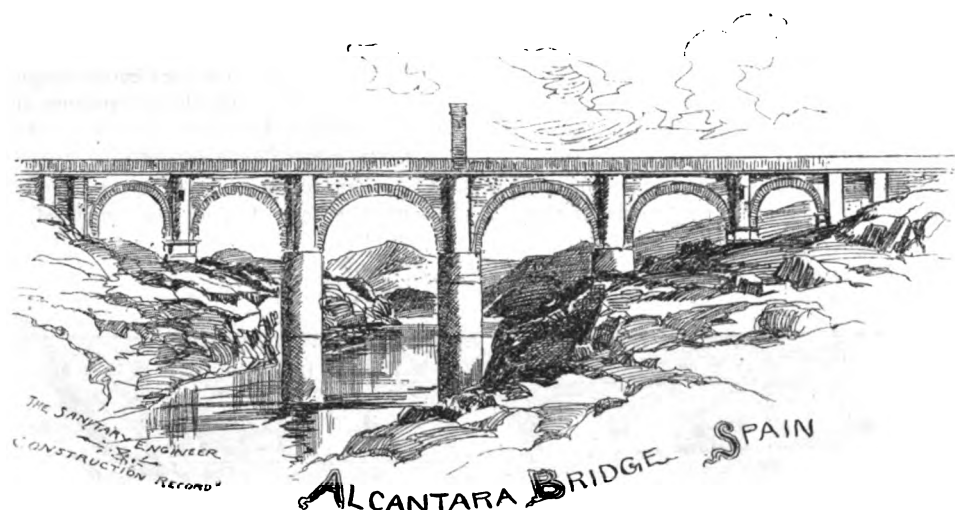
Another Roman bridge, 2,400 feet in length, near Lyons, in the south of France, was also erected by the Romans.

Among the later Roman arched bridges may be mentioned the Devil's Bridge over the Serchio, Italy, which is, in some respects, the most remarkable in the whole history of stone bridges, being only twelve feet wide between the parapets, and spanning a stream in which the floods rise sometimes nearly to the crowns of the arches, and yet, while every other structure on the turbulent Serchio has been swept away, this bridge has withstood the floods of nearly nine centuries.

The bridge of Trezzo, built in 1380 by Bernabo, Visconti, Duke of Milan, consisted of a single arch of granite of 251 feet span, the largest stone arch probably ever erected. It was destroyed by Carmagnola 120 years after its erection.

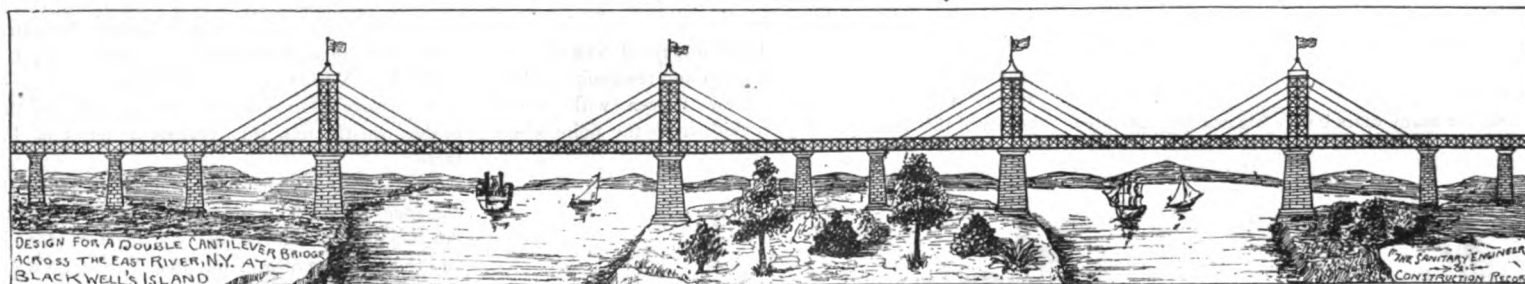
The aqueduct bridge of Alcantara, near Lisbon, begun 1713, and finished in 1732, consists of thirty-five arches of various dimensions, the largest having a span of 108 feet.

The bridge of Neuilly, which crosses the Seine, built between the years 1768 and 1780 by the famous Perronet, is considered one of the most beautiful of existing bridges. It consists of five equal arches of 128 feet span each, each arch being composed of eleven arcs of circles



years ago by the most vivid imagination. They are triumphs of science rather than of art, and as such we should, perhaps, be content to look upon them; deriving our interest from cold, unimpassioned reflections upon the thought, the genius, and the skill which have produced them, rather than from any such pleasing emotions as

arches of 780 feet, and on these is supported a third tier 850 feet in length. This brings the structure up to the level of the aqueduct, which rests on the third tier of arches. This extraordinary structure is built of very large stones put together without cement and held together by iron clamps. The whole height is 190 feet above the river.



arise when we look upon some of the works of the same kind of the older bridge architects.

The most ancient bridges of which we have any precise knowledge were built by the Romans, all those of a permanent character having been arched masonry bridges. It is certain, however, that such bridges were built in China many centuries ago, but of their history little is definitely known.

Of the Roman bridges that erected by Trajan across the Danube is said to have been the most magnificent. It consisted of nineteen arches, each 170 feet span, the piers rising 120 feet above the foundations. The width of the bridge was 60 feet, and its total length 1,500 feet. This bridge was destroyed by the immediate successor of Trajan, Hadrian, for fear that it might afford an easy passage for the barbarians into the Empire. Some of the piers are still to be seen, however, near the town of Walke, Hungary.

The next considerable work of this kind built by the Romans is the Pont du Garde, which is still standing. (See cut.)

It served the double purpose of a highway bridge over the Gardon and an aqueduct for supplying with water the town of Nismes in the south of France. The bridge is a triple arcade, the lower tier of arches having a total length of 660 feet, and supporting a second tier of eleven

Another Roman bridge over the Tajo at Valenza, about 25 miles from Madrid, 679 feet in length, and consisting of only six arches, was built at the time of Trajan. It is now standing, but not used.

A single arch near the old town of Brionde, in France, having a span of 181 feet, and which is said to be still standing, is attributed to the Romans.

of different diameters, the resulting effect being a curve in appearance like an ellipse, but even more pleasing to the eye than an ellipse.

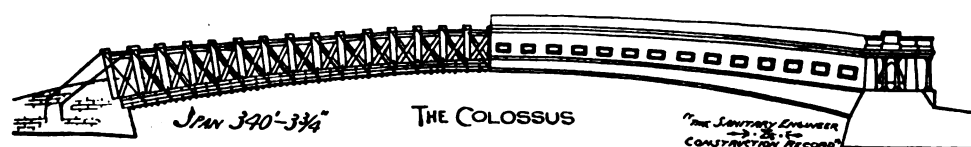
In England the oldest bridge remaining entire is the bridge of Croyland, in Lincolnshire. It was erected about the year 860.

The first bridge over the Thames was of wood, built in



the reign of Ethelred II., about the year 1000.

The Old London Bridge was begun in 1176, under Henry II., and finished in 1209. The length was 940 feet, the height 44 feet, and the width between the parapets 47 feet. It was hardly much more than a wall of stone thrown across the river, a few openings being left for the passage of the waters of the Thames, half the

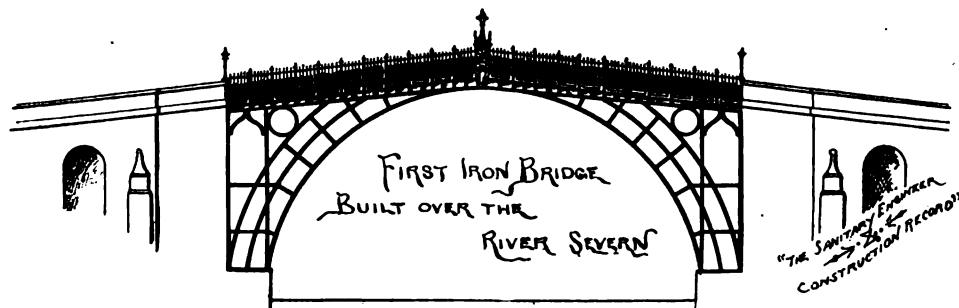


water-way being taken up by the piers. It was extensively repaired and altered five hundred years after its erection, and in 1823, the obstruction which it offered to traffic on the river having become the subject of persistent and loud complaints, this bridge was removed and the New London Bridge erected in its place by Mr. John Rennie. The new bridge was placed near the site of the old bridge, and is formed of five semi-elliptical arches, the least of which is larger than any elliptical arch ever before erected.

The Westminster Bridge over the Thames was constructed by a Swiss Engineer, Mr. Labalye. It is 1,220

as well as magnificent in its proportions, erected by Mr. Roebling across the East River between New York and Brooklyn.

In timber bridges America has taken the lead of all other countries, the only structure in Europe comparable with the great timber bridges built in this country during the early part of this century being the Schaffhausen and Wittengen Bridges across the Rhine, built by Ulric Grubenmann. A stone bridge that had spanned the Rhine at Schaffhausen having fallen, a model of a wooden bridge to supply its place was presented by Grubenman, and



feet long, and consists of thirteen large and two small arches. It was opened to the public in 1750.

Blackfriars Bridge, also one of the London bridges, was built by Mr. R. Mylne, between the years 1760 and 1771. It is 999 feet long and consists of nine elliptical arches.

The Waterloo Bridge across the Thames nearly midway between the Westminster and the Blackfriars bridges is, perhaps, the most magnificent structure of its kind in Europe. It was built by Mr. Rennie, and is composed of nine elliptical arches, each having a span of 120 feet. Its length is 1,380 feet.

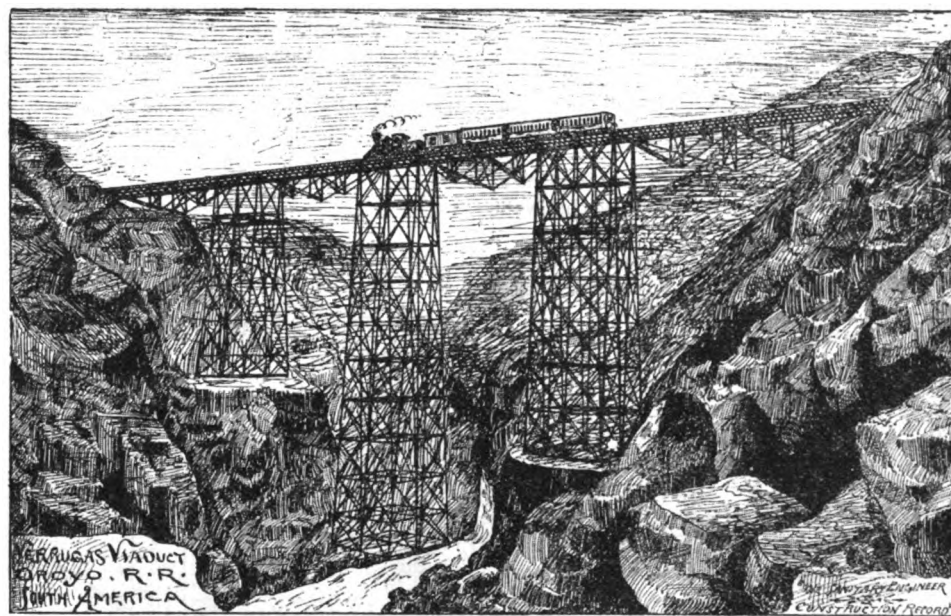
The first cast-iron arched bridge was built across the river Severn at Colebrookdale, England, by Mr. Darby, in 1779. Some years after Thomas Paine made preparations for erecting a similar bridge at the same place according to plans which he had prepared in this country, and caused his bridge to be erected for exhibition in a meadow near

accepted. This extraordinary work was completed in 1758. The length of each span was 364 feet. It was destroyed by the French in 1799.

Another famous bridge of timber, called the Colossus of Fairmount, was erected over the Schuylkill, at Philadelphia, by Luis Wernag, towards the close of the last century. It had the form of a very flat arch, having a span of 340 feet. Its slender, graceful appearance was much admired.

Fannie Kemble, in her journal, compared it to a "scarf rounded by the wind and flung across the river." It was destroyed by fire in 1838.

Timothy Palmer, of Newburyport, Mass., built several notable bridges, one of which crossed the Schuylkill at Philadelphia. The construction was a combination of king-posts and bracing with the arch. Another was built across the Piscataqua River about seven miles above Portsmouth. Both these bridges received extended notices in both American and foreign journals.



Colebrookdale, but having no funds to erect the bridge across the Severn, it was removed from the meadow and parts of it used for a bridge over the Wear in 1793.

Vauxhall and Southwark bridges over the Thames were of cast iron. The latter, built by Mr. Rennie, was composed of three cast-iron circular arches, the central arch having a span of 250 feet. Ten years were occupied in its construction.

Iron suspension bridges were constructed in Europe as early as 1615, but this class of bridges had already existed in Asia, Africa, and America at much older dates. The Spaniards found a suspension bridge in Peru, built by the fifth Inca, the cables, four in number, being composed of vegetable fibre, and the floor made of rushes. This bridge was systematically repaired every six months and remained standing and in use up to a very recent date.

Telford constructed a suspension bridge across the Menai Straits of 560 feet span, which at the time was regarded as a great achievement. All suspension bridges of the old world are, however, insignificant in comparison with the great bridge, beautiful in design and appearance,

Among the architects of notable timber bridges during the early part of the century appear the names of Burr, Towne, Long, and Howe—Long and Howe having followed Towne, and produced modifications of his truss to which their names have since become attached.

Towne's truss was such a remarkable and important improvement—the application, in fact, of a new mechanical principle in bridge building—that it was immediately extensively copied, the most important example being the bridge erected across the James River at Richmond, built by Mr. Moncure Robinson. The total length of this bridge was 2,900 feet. It was supported on eighteen granite piers at distances apart varying from 130 to 150 feet, the total cost being about \$100,000. Other bridges on the same principle were built, one across the Susquehanna 2,200 feet, with span of 220 feet; another at Nashua, N. H.; at Newburyport, Springfield, Northampton, Philadelphia, Trenton; one near New York, another near Troy, and many others in the Southern and Middle States.

These bridges have nearly all disappeared, wrought iron having taken the place of timber, while the principle of Towne is still preserved in new constructions.

Of wrought-iron bridges it is hardly necessary to refer at this time, since they belong to our own period, and are the work of engineers of our own day.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

BY WILLIAM R. BILLINGS, C. E.
Superintendent of Water-Works, Taunton, Mass.

NO. II.

(Continued from page 463.)

FIELD WORK.

It goes without saying to the readers of THE ENGINEERING AND BUILDING RECORD that the best preparation for any considerable amount of main-pipe laying is found in a careful survey of the proposed line, which shall take note of every feature which is likely to affect the work. Cross streets or roads, existing or proposed, brooks, bridges, drains, culverts, sewers, gas-pipes, and old water-mains, if there be any, should be indicated on plan and profile, and forethought given to schemes for avoiding and overcoming evident obstacles.

Let me warn the novice that, in spite of his most earnest forethought, obstacles that could hardly be foreseen even by one of experience will almost certainly arise, and he can at best only strive to reduce the number of the unexpected difficulties.

The need for laying pipes to line and grade is an imperative one on the main line from a reservoir in a gravity system; is almost as necessary with any main larger than ten or twelve inches, though perhaps less important in the smaller pipes through the streets of a town.

A town may build a respectable system of water-works with a wonderfully small amount of engineering, but money saved at the outset in this way is generally expended at a later date in correcting blunders and repairing defective work. The writer calls to mind at this moment an instance in which a defective length of pipe which was made a part of a submerged river-crossing has since caused an expenditure of not less than \$2,000 at different times for repairs; enough to have paid for a reasonable amount of engineering and thorough inspection.

Let us suppose that full surveys and drawings have been made: in what form, then, shall they be put, so as to be intelligible to the foreman in charge of the gang? If an assistant engineer is constantly on the trench, he may not need a full drawing; his own notes made at the office may be sufficient, but this arrangement is not always practicable. We give herewith Fig. 10, a sketch copied from blue prints used by Mr. R. P. Coggeshall in his work at New Bedford, Mass. These sheets are not large, 10x15 inches or less, and are given to the foreman a few days before the beginning of work, so that he may get the gates, hydrants, and specials on the ground in advance of the digging. The writer has followed essentially the same plan, but in his drawings no attempt is made to show the form of the special castings. Single or double lines, with the names of the castings and size of gates, the whole drawn to scale of forty feet to one inch, are used as shown in Fig. 11.

If a draughtsman is available the first method is certainly to be preferred, but if one must be his own engineer, superintendent, and draughtsman, as is often the case in small towns, the second method has its advantages.

These pipe plans represent the best practice, but if the earth could be thrown off some main-pipe systems, as the valet of Frederick the Great used to throw the bed-clothes off his master in the morning, the easy curves and special angles which the foregoing plans provide would not be found.

I once heard a man of wide experience in handling pipe say that he could lay cast-iron pipe in the crookedest town that was ever laid out on the cow-paths, if he had single branches and plenty of pipe. Such work is not to be commended, but it has been, and probably will be, done.

It would be outside the scope of these papers to describe methods which may be employed in locating a pipe-line and staking out the curves and angles according to railroad practice, but some beginner may be glad to receive some suggestions as to methods. When he is given a gang of men, a quantity of straight pipe, and told to lay a main on B Street from a given point to a branch on S Avenue, the location of the branch will be given with more or less accuracy, but at points all askew for B Street, and the street itself straggles along to a junction with the avenue in a tangential, uncertain sort of way that is more picturesque than satisfactory.

The first comforting fact is that we *can* swing around the sharpest curve which is likely to present itself by cutting the pipe into short pieces and making the joints as one-sided as we dare.

We must have a line of some kind—sash-cord or clothes-

line are first-rate for the purpose—so that we can fasten one end of it to a point in the ground nearly over the branch, say 18 inches to the right of it. Now let a man take the ball or coil of line and stretch it in the direction in which the branch points, as nearly as can be judged. Suppose the line is to swing to the right, let one laborer drive his pick into the ground close to the line, on the right of it, and 12 or 15 feet from the fastened end. Keep the line stretched, swing it to the right again, and have another pick driven into the ground 25 or 30 feet from the fastened end.

When a hundred feet or more of line have been stretched

In loose, gravelly and stony ground the temperature will frequently fall below 32° Fah. for a depth of 5 or 6 feet, and hydrant-branches and service-pipes have frozen under such conditions. In compact earth free from large stones, the ground is not frozen more than 3 or 4 feet, and under good sod the distance is even less than that. These figures will hold good, I think, as far north as the isothermal line of Portland, Me.

Any section of a main pipe-line which is sure of a good circulation may be laid at any convenient depth without regard to temperature, and examples may be cited of main pipes which cross bridges without any protection from

Time-keeping, if one wishes to know with exactness the cost of the whole or any portion of a season's work, is an important detail, and a convenient and well-designed time-book is almost indispensable to good results. A sample page from the time book in use by the writer will illustrate one method which has been well tried and is not found wanting:

#2.25	Bay St.	High St.	#1.75	Bay St.	High St.
Jack Cade			Tim Daley		
49 Time	August		50 Time	August	
1	Tr		1	BH	
2			2	BH	
3	Tr		3	BH	
4	Tr		4	BH	
5	Tr		5	Tr	
6	Tr		6	C.S.P.	
7	Tr		7	Tr	
8	Tr		8	Tr	
9	Tr		9	BH	
10	Tr		10	BH	
11	Tr		11	Tr	
12	Tr		12	Tr	
13	Tr		13	Tr	
14	Tr		14	Tr	
15	Tr		15	Tr	
16	Tr		16	BH	
17	Tr		17	BH	
18	Tr		18	BH	
19	Tr		19	Tr	
20	Tr		20	Tr	
21	Tr		21	Tr	
22	Tr		22	Tr	
23	Tr		23	C.S.P.	
24	Tr		24	Tr	
25	Tr		25	Tr	
26	Tr		26	Tr	
27	Tr		27	Tr	
28	Tr		28	Tr	
29	Tr		29	Tr	
30	Tr		30	Tr	
31	Tr		31	Tr	

FIG. 12.

With the aid of this book we have been able to tell with satisfactory exactness at the end of a season's work where every dollar of the pay-rolls has been expended.

For example, the page here given tells us that Jack Cade is number 49 in the gang; that he is paid \$2.25 per day; that on the first day of August he worked only during the forenoon, in the derrick-gang on Bay Street; on the second he made a full day in the same position; on the third

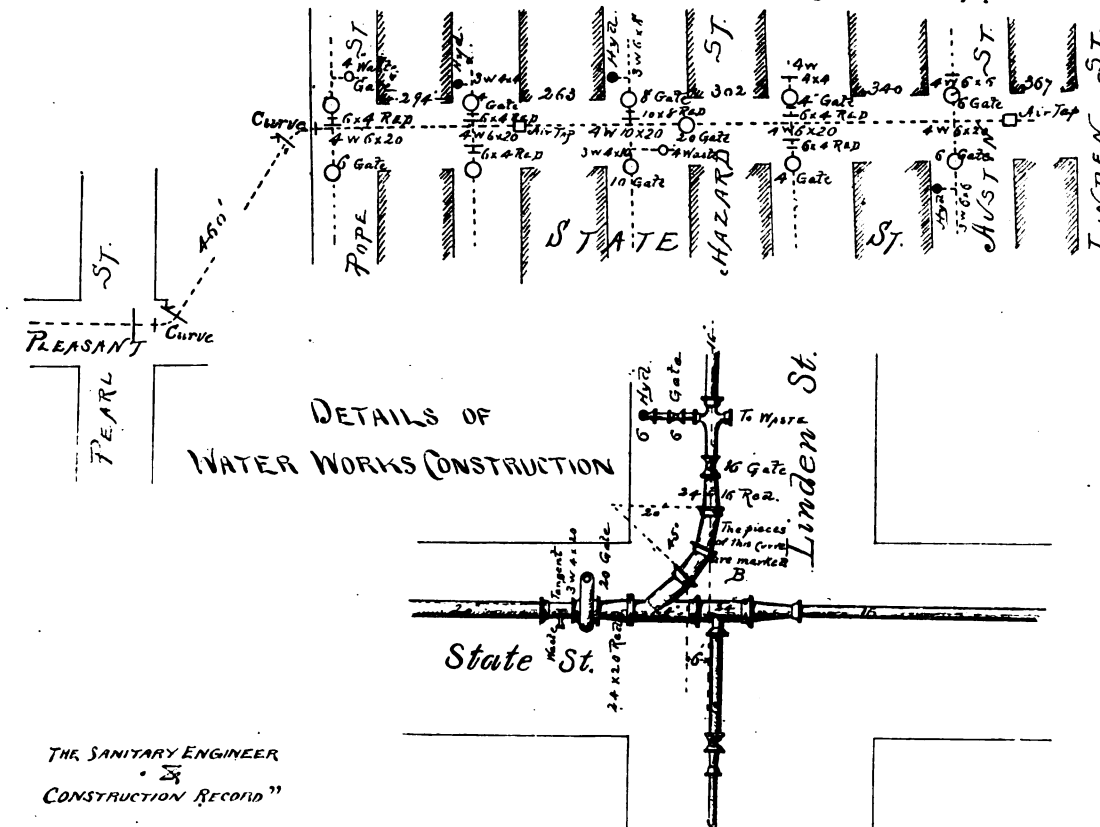


FIGURE 10.

in this way, set a half a dozen men to picking a rut along the left side of the line. Make them follow the line; don't let them walk backwards, and see that they all pick on the same side of the line; it is safe to say that half of them won't if you let them alone. The sections may be measured by laying down a shovel-length four times, or, if the digging is sandy, 15 feet is not too much.

The width of the trench may vary from 28 to 36 inches,

freezing except that afforded by the current of water constantly moving through them. Exact information upon this point is desirable.

There is a sort of unwritten law, in New England at least, that the axis of all pipes should be five feet below the surface.

If the amount of work on hand justifies the employment of not less than forty or fifty men, it will require the attach-

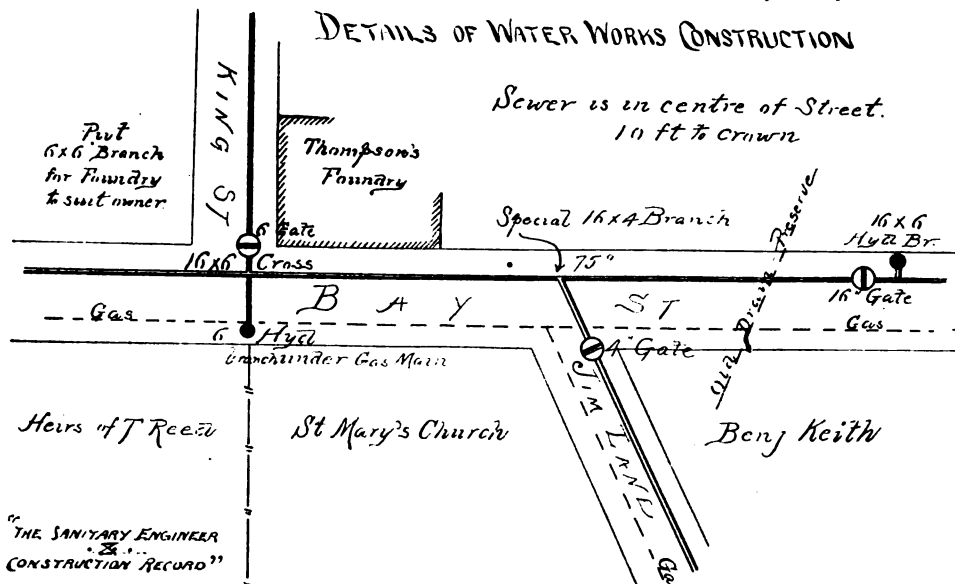


FIGURE 11.

depending on the size of the pipe, though if the soil is known in advance to be sandy, and likely to cave, it may be cheaper to start the trench four feet wide on top, and slope it towards the bottom, rather than to use bracing.

The depth to which pipe may or must be laid is controlled by more than one consideration.

In northern latitudes protection from frost is first to be thought of, and the amount of covering required for this depends upon the nature of the ground, the size of the pipe, and the quantity of water flowing during the hours of minimum flow.

tion of one capable man whose duty shall be those of a foreman of the trenching gang.

The right man in this position will have no lack of work. He can keep the time for the whole gang, lay out the trench in advance, see that the damage from the excavated dirt is reduced to a minimum, keep private driveways open, look after the bracing of the trench if this be found necessary, see that the trench is dug to the line and grade given, keep the unoccupied side of the road as free as possible, and finally pick out the fellows who are trying to shirk and get rid of them.

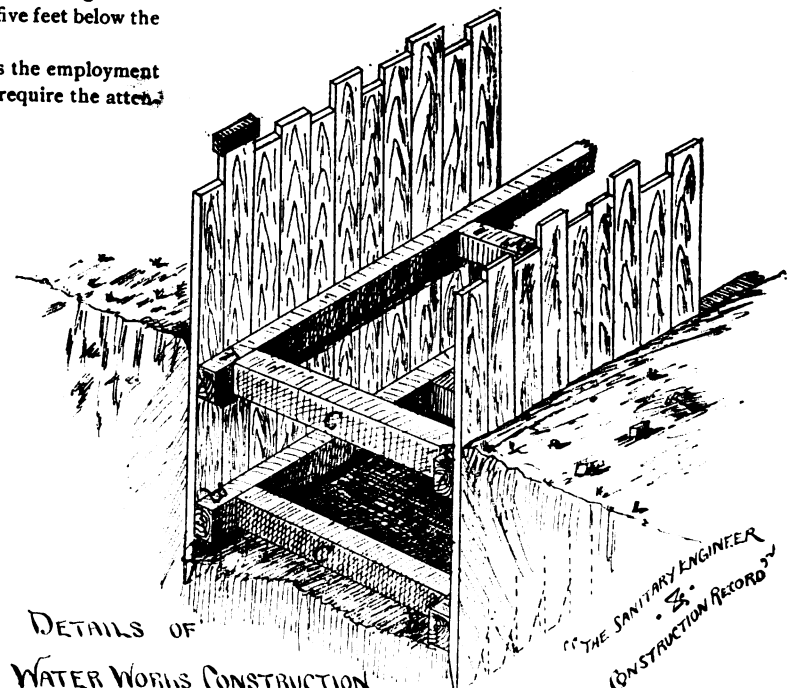


FIGURE 13.

he did not begin until the middle of the forenoon, finishing out the day. As pay-day comes once a week the space belonging to Sunday is utilized to put down the footing of total time for each week. On Tuesday, the seventh, Cade during the forenoon worked on Bay Street and on High Street after dinner, and Ck. shows that he was employed in calking joints. In Tim Daley's record B. H. stands for "bell-hole digging," B. F. for "back filling," Tr. for trenching, and C. S. P. (construction service-pipe) shows that Daley was taken from the main pipe gang on those days and sent to dig service-pipe trenches.

Cedar



Street

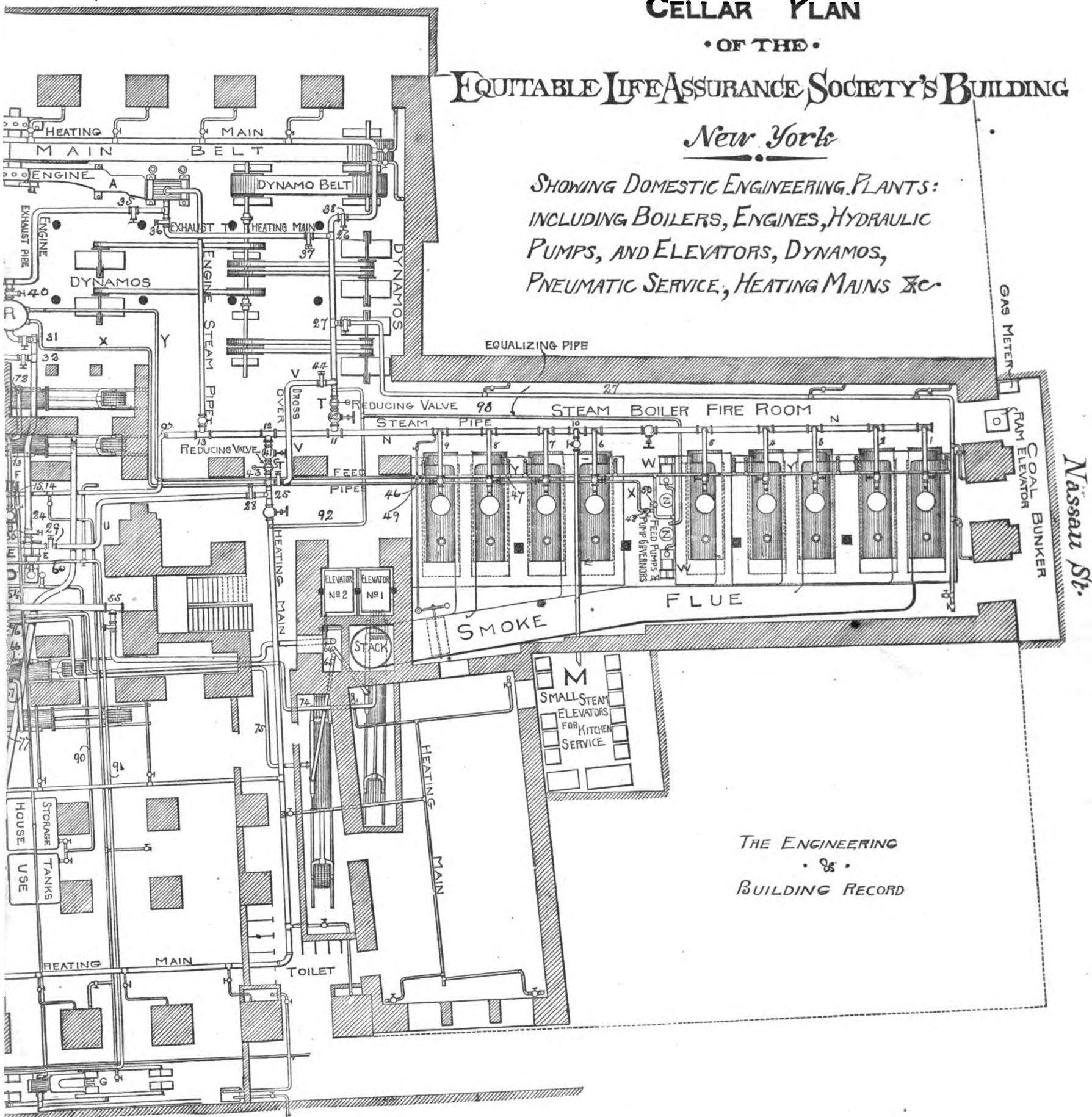
CELLAR PLAN

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Nassau St.

THE ENGINEERING
• 85 •
BUILDING RECORD

Street

In working through the streets of a town, especially in the portions occupied by well-kept estates, it is well to remember that a man with a newly-painted fence or a bit of smooth grass-plot is very unwilling to allow gravel or clay to be thrown against his fence or on to his lawn, even if the street be narrow and the workmen cramped for room. A few hemlock boards do not cost much and may save considerable growling, for if they are judiciously placed against the fence they will protect both it and the lawn. Under these conditions, however, there is some danger, if the dirt reach nearly to the top of the fence, of straining the structure and throwing it out of line. If this happens the fence must be straightened and the bill paid.

When tunneling is impracticable driveways and cross-streets may be kept in constant use by opening the trench half way across the space, leaving just driving room, and then digging on as usual. When the pipe-line is brought up to the undisturbed portion, the last two or three joints may be made without waiting for others, then enough of the trench immediately filled to furnish new driving room, and the undisturbed portion dug out by the derrick gang in quick time.

Bracing, if done to any considerable extent, is expensive work, but as it is not right and does not pay in Massachusetts to expose men to risk of injury, bracing the trench is sometimes not to be avoided.

If the tendency to cave is only slight and the trench is not more than five feet deep, sufficient support may be given by single planks running along just below the edge of the trench and held in place by short pieces of 4x4 joist, which are cut a little longer than the distance across the trench between the planks, and then driven in place with sledges.

In loose gravel or sand this sort of bracing amounts to little or nothing, for the stuff will run out from under the planks and finally tumble everything into the ditch.

Water-pipes are seldom laid to a depth which requires the thorough bracing and sheet-piling of deep sewer-work, but a simple sketch and a few words of explanation will make plain the vital points involved in the construction of ordinary sheet-piling. After excavating four feet in depth, a trench which must go four feet deeper, in quicksand, for example, may be braced as indicated in Fig. 13. Lay the 4x6 stringers B along the bottom of the trench and put a 10-foot plank between each end and the bank. Cut cross-braces C long enough to drive in hard, and then fix the top stringers T in the same manner; the next is simply driving plank to make the sheet-piling complete.

The one thing needful to make sheet-piling thoroughly effective is to keep the ends of the plank as much below the bottom of the trench as is possible, and to this end each plank should be driven frequently if only a little at a time. If the ends of the plank are cut this way—that is, chamfered and pointed—so as to help to throw them back against the bank and sideways against the plank last driven, better work can be done than with square-toed plank. If the amount of driving is considerable it will pay to protect the ends of the planks by a wrought-iron cap. Driving is to be done with wooden mauls, six inches or more in diameter and twelve inches long, bound with rings of wrought iron.

(TO BE CONTINUED.)

DR. E. W. BUCK, who is Health Officer and City Physician of Oakland, Cal., in his report for the year 1886, gives the number of deaths during the year as 583 and estimates the population at 46,000, giving a death-rate of 12.67 per 1,000. It is, of course, much more probable that the population has been overestimated, and that the true death-rate is at least 15 per 1,000, which, though low, is not an improbable rate for a new Western city like Oakland.

As Dr. Buck remarks, the large area of the city and the fact that most of the houses are isolated, together with the equable climate and good sewerage, explain in part the low death-rate. Probably, also, the comparatively large proportion of adults and the absence of a tenement-house population have much to do with the low death-rate. Reference is made to the usual troubles connected with dumping of garbage, and it is recommended to buy more land for the purpose. Probably the wisest course would be to construct a cremating establishment at once and prevent all danger of soil pollution.

The appended report of Mr. Snook, the sanitary and plumbing inspector, shows that the plumbing regulations are being enforced with good results.



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. II.

(Continued from page 522.)

THE new Equitable Building, in this city, an illustrated description of the plumbing of which appeared in our last issue, is one of the finest commercial structures in the world. It was formally opened for business on May 1, 1887, but, as a matter of fact, there are yet many artisans employed in and about the building, some of whom may not be dispensed with for a year to come. When fully finished and equipped, it will contain, without much doubt, the greatest domestic engineering plant of this continent, or, presumably, any other. Money has not been spared in making it not only imposing in appearance, but, from the foundation up, it is notable for solidity and strength. It is fire-proof in so far as knowledge on the subject goes; it is believed that no fire started within the building could gain headway, and that the building would stand against a general conflagration outside. The best known modern appliances, in the judgment of the architect and engineer, for convenience and dispatch has been adopted.

The building occupies an entire block, with the exception of Nassau Street corners. It is bounded by Broadway, Cedar, Pine, and Nassau Streets respectively, it being one block north of Wall Street. The main corridor runs clear through the building—lengthwise—from Broadway to Nassau, and forms the main entrance from both streets. In addition, there are wide passageways leading from Pine and Cedar Streets, the meeting of which with the main corridor forms the shape of a cross, which, being covered and level with the street, makes it a convenient and much-used thoroughfare.

The frontage on Broadway is 167½ feet, on Cedar and Pine Streets 224 feet each, and on Nassau Street 46½ feet. The extreme depth of the building from Broadway to Nassau Street is 308 feet, the exact ground plan of which is shown in Fig. 1. The building is eight stories high. A central tower rises to a height of 172 feet from the ground. A central court, open to the sky above the first story, affords light and air to the inner rooms. The portion of this court intersected by the main corridor is covered by an arch of stained glass, on which there is much artistic display. The arcade thus formed is largely occupied at the sides by a variety of stores and offices of a public character, such as express, telegraph, messenger, telephone, etc., while a large part of the ground floor adjoining the arcade is used as a high-class public restaurant.

The building has a permanent and transient tenancy. Among the former are the "Mercantile Safe Deposit Company," whose offices, safes, and vaults occupy a large portion of the ground floor and cellar; the Mercantile Trust Company; the offices of the Equitable Life Assurance Society located on the second or "Equitable" floor, and the U. S. Signal Service Department, whose offices are in the tower. Certain portions of the building are fitted up expressly for tenants of a certain class—for example, banks, money, note, financial, and real estate brokers.

A special feature of the building is its Law Library, containing over 7,000 law volumes, also a daily supply of the latest law publications. It is reserved exclusively for the use of the tenants of the building. There are a number of alcoves, with tables, chairs, and writing material in this room, which is located on the fifth floor, adjoining the Law Club. On the ground floor the Mercantile Safe Deposit Company provides for tenants' use reading, smoking, writing, and coupon rooms, also a ladies' parlor.

Rooms in the building are also set aside for references, arbitrations, conferences, and general meetings; these are hired by the day for the purposes mentioned.

On the third, fourth, fifth, and sixth floors there are some sixty-eight to seventy rooms, all similarly arranged. On the seventh floor the arrangement of offices

materially from that on the other floors; every alternate room is larger than that adjoining, and the windows differ in size and shape; the smaller rooms contain closets valuable for permanent storage of articles, clothes, etc., while the windows of the large rooms have window seats and book-shelves on either side. The eighth and highest general floor contains a great number of small rooms, those fronting on Broadway being considered especially suitable, on account of the unobstructed light and high, clear position, for architects, engineers, etc.

The height of the eighth floor is 135 feet from the ground, while that of the tower is 178 feet, making the tower 43 feet above the eighth floor. Here is located the private retreat of the President of the Equitable Life Assurance Society. It is reached by an elevator erected on the ninth floor, which operates from the President's rooms on the second, or "Equitable," floor to this quiet retreat on the eleventh floor. The tower is occupied, also, by the U. S. Signal Service Department, the roof being given up to displaying the various signals for the benefit of the shipping in New York Bay and Harbor, and also for the surrounding country.

The building is heated by direct radiation, which will be spoken of hereafter. Some of the rooms are provided with open fire-places. Complete toilet-rooms for male and female, representing a high order of sanitary art, are centrally placed on each floor.

With the exception of the single elevator above mentioned as being on the ninth floor of the building, all of the machinery, including engines, dynamos, pumps, etc., are located in the cellar, which is 15 feet below the ground floor.

STEAM TO ENGINES AND MACHINERY.

Referring to cellar-plan, it will be seen that the steam-boilers, 9 in number, are located in the wing of the building which runs toward Nassau Street. Here the steam for all purposes is generated and maintained at a pressure of about 80 pounds per square inch above atmosphere. It is carried direct to the dynamo-engine A, to three large hydraulic elevator steam-pumps B B B, the Knowles pump C, the three small duplex pumps D E F, the engine G that drives the four dynamos comprising a permanent electrical exhibit of the U. S. E. L. Co., whose offices are in the building, the engines H I that furnish the power to the Root blowers J K for pneumatic service, and the air-compressor L for the same; also the 13 steam elevators for kitchen and restaurant service located at M, and finally the steam-heating service of the building, direct, through reducing-valves T T, reduced to five pounds pressure, when the exhaust steam from the engines, pumps, etc., is not sufficient.

The system of elevator and other mechanism here represented was designed by and erected under the personal supervision of Mr. James F. Wilson, who occupies the position of superintending engineer, whose duties extend not alone to the New York or parent building, but also to the various buildings of the Equitable Life Assurance Society in other cities. He has held the position for 13 years and enjoys the entire confidence of the company; practically he was restricted in nothing, so that the Equitable engineering plant, of which we give very full illustrations, may be looked upon by our readers as a typical domestic plant of a New York building, there being presumably nothing of its class approaching it in magnitude in the world. It is proposed to explain the general working of the plant as a whole, and treat of each division separately hereafter.

Beginning at the boilers, the steam is taken off by the branches 1, 2, 3, 4, 5, 6, 7, 8, 9, each 6 inches in diameter and all connecting with one main steam-pipe, N, which from branch 2 to the end is 10 inches diameter; from branches 4 to 2 is 12 inches diameter, and from here to the 9th branch it is 14 inches diameter; from the elbow O, to the first of the 3 pumps it is 10 inches diameter; the remainder of the way it is 7½ inches in diameter.

The first branch taken from this main is that marked 10, which is 6 inches diameter and conveys steam to the 13 steam-elevators that are to carry waiters, dishes, etc., from the restaurant and cafe on the ground floor to the kitchen on the eight floor, also to the cafes of the several clubs on the fifth and sixth floors.

The next branch, marked 11, is 10 inches diameter and is the regular heating-main going around by the north side; the following one, marked 12, is also 10 inches diameter and is the heating-main for the south wall. These are shown and thus make the circuit of the

The main steam-pipe is next tapped at 13 by a 10-inch steam-pipe which conveys steam to the 450-horse-power Corliss engine, made by the Watts-Campbell Co., of Newark, N. J. Beyond 13 the main steam-pipe is reduced to 10-inch diameter and turns to the south, not only to avoid a wall, but to give the necessary bend for expansion. At 14 a 2½-inch pipe takes live steam to the laundry on the ninth and also to the kitchen on the eighth floor, also to a hot-water tank in the cellar for hot-water service of the building and janitor's uses.

Through a 4-inch pipe at 15 steam is taken off for the engine of the electric-light exhibit, located at B. At 16 a 3-inch branch (not shown) gives steam to the three Worthington pumps located at D E F. At 17, 18, 19 branches four inches in diameter convey steam to the three large elevator pumps, a side view of which will be hereafter. At 20 a 4-inch pipe takes steam to the shown Knowles duplex pump marked C, while the last branch 21 conveys steam to the engines H I L of the Pneumatic Service Co. The steam-main then continues on over the edge of the elevator water-tanks, P P, where it bends down into the tanks, the object being to open the valve 22 and quickly empty the steam-pipe when repairs are to be made. Following in like manner is the 10-inch exhaust-pipe, Q, from the three large pumps. This pipe receives the exhaust of the Knowles pump at C and the exhaust of the elevator pumps B B B.

At 24 a 10-inch branch turns northward toward the heater R and the main vertical exhaust-pipe S. From 24 the exhaust-pipe continues straight ahead, with exception of the expansion-bend U, until it enters the heating-main at 25; in the same manner the exhaust-pipe of the steam-engine A, 10 inches in diameter, goes direct to the heater R and from thence to main vertical exhaust-pipe S; also connects with heating main at 26. The "cross-over" pipe V is introduced to enable the exhaust of the several pumps, etc., to be carried over to the north wall of the building, and the engine-exhaust to go around the south side when found necessary. At 27 a heating-main of six inches diameter runs along in front of the boilers, carrying heat to Nos. 17, 19, and 21 Nassau Street.

The exhaust-steam from the engines and pumps is utilized in warming the building by a system of valves. The possible combinations for diverting the several exhausts are numerous and important. By closing valve 30 and opening valves 28 and 29 the exhaust from the three large pumps B B B, the three air-compressor engines, H I L, the engine of the dynamo exhibit G, also from the three small pumps D E F, go directly into the heating-main that follows the south wall of the building. By closing valves 29 and opening 30 and 31 those several exhausts go directly up the exhaust-pipe S to the atmosphere. By closing 32 and opening 31 it is then diverted into the heater R, where it is used to heat the feed-water for the boilers.

When this combination is in use the valve 33 is left open for final escape by way of valve 34. Valve No. 34 is a "Kieley" back-pressure valve, which allows all the surplus steam over five pounds pressure to escape up the exhaust-pipe S should the heating-mains not require it.

The exhaust steam from the main engine A is provided for in the same manner. When valve 35 is closed, and 36, 37, and 38 are open, the exhaust may go direct to the heating mains that follows the north wall of the building. When valves 36 and 39 are closed and 40 and 35 are open the exhaust may go direct into the feed-water heater R and escape to the main exhaust-pipe S by way of valve 34 as before. By closing valve 40 and opening 39 the exhaust steam has a clear passage to the atmosphere without going through the heater. The cross-over-pipe V is used when the north side of the building requires more steam than the south side and there is a surplus to spare, then the exhaust from the pumps, etc., can be diverted to suit the demands, the same as of the south side borrowing from the north in case of a like emergency.

At a point between the heater and the heating-mains a Stewart oil extractor is placed to prevent contamination of the feed-water and save the grease of the oil from the various cylinders.

The usual way of running during the cold season is with all of the above-mentioned valves open, more or less, with exception of 32 and 39. This insures the feed-water being heated by the several exhausts passing through the heater; the pressure throughout the mains being kept at five pounds pressure by the action of the back-pressure valve 34, and a general equalization of the pressure on the north and south sides of the building. During the sum-

mer season the valves 36 and 29 are closed to keep the exhaust steam out of the heating-mains, the proper combination of closed and open valves diverting it to the feed-water heater, or directly up the exhaust-pipe in case the latter is undergoing repairs, etc.

When the latter system or combination is in use the lever of the back-pressure valve is hung up for the season, which makes a free exhaust through the heater and up the exhaust-pipe S to the atmosphere.

On some occasions live steam is turned into the heating-mains through the globe-valves marked 41 and 42. Immediately adjoining those valves are placed reducing-pressure valves that allow automatically only the pressure for which they are set to pass through them—viz., five pounds. These valves are special "Kieley" make.

Thus in the steam-heating system the following is allowed for: (1) The heating of the building by live steam on holidays or Sundays when engines are not running; (2) heating by exhaust-steam from the various steam-engines and pumps when they are running; (3) heating by the use of both at once; (4) shutting off steam completely from the south side of the building by closing valves 29, 44, and the valve marked 45 located in the offices of the Mercantile Safe Deposit Co., under the Broadway sidewalk; (5) assisting either side by additional exhaust-steam as found necessary by means of the cross-over-pipe V.

(TO BE CONTINUED.)

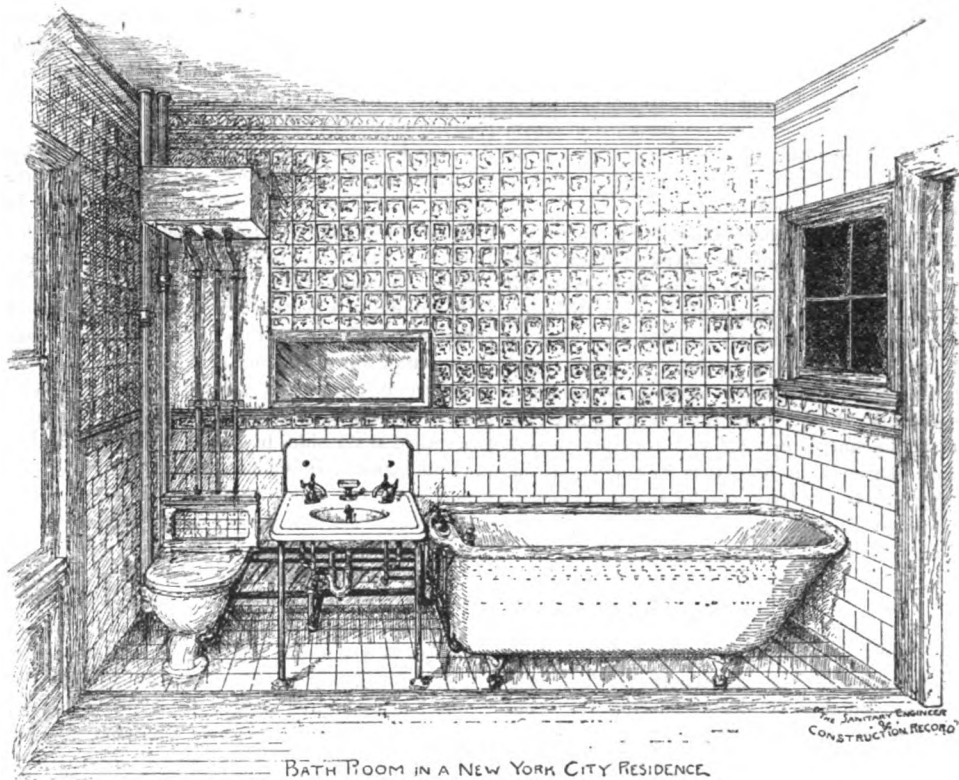
A BATH-ROOM IN RESIDENCE OF MR. E. H. WALES.

We illustrate herewith a bath-room in which the novel feature consists in the placing of all traps and waste pipes above the floor and inside the room exposed and accessible. The only wood-work in the bath-room is the seat of the water-closet, the casing of the cistern, and the rim of the bath-tub.

All waste-pipes and water-supply pipes from the fixtures are brass, nickel-plated. All traps are above the floor and

city has resulted in the discovery of many violations of the plumbing and tenement-house laws which might otherwise have escaped notice. For example, during the week ending October 8 there were reported to the Chief Inspector 200 violations, or at the rate of about 10,000 yearly. The last week or two has also witnessed a considerable number of prosecutions and sentences, some remarkable for the determined effort to commit a fraud in the violation, others for the criminal and useless carelessness of the work complained of. In the case of Brandt Bros., for instance, it is difficult to see what expense was saved by the bungling way in which the work was done. Indifference and disregard of the future tenants and criminal neglect to secure good workmanship are the only apparent causes for this piece of work. That the builders are held to answer before Special Sessions is a good thing, calculated to have some effect in developing a sense of responsibility in other builders who might follow their methods.

One of the most objectionable cases is that of George C. Angell, a builder. Our readers will remember the fall, a few years ago, of a block of tenements built by Buddensieck, who is now, perhaps, learning more honest workmanship in the Penitentiary. These lots—on Sixty-second Street, near Tenth Avenue—were bought by Angell, who recently consulted with the Board of Health on the possibility of rebuilding on the Buddensieck plan, once approved by the board. He was informed new plans must be filed, as changes in the laws invalidated the old ones. One set of plans, then presented by Angell, were rejected, because they did not conform to the requirements of the law relating to air-courts, etc. Then Angell, about June 30, filed new plans, which were almost models. Of course they were passed by the board, and Angell began to build. But the inspector discovered that the buildings were going up in accordance with the plans which the board had rejected, showing a manifest expectation that the inspector would not detect the variation. A warrant was procured by the Board of Health, Angell was arrested, and then the board learned that he claimed to be building under the



BATH ROOM IN A NEW YORK CITY RESIDENCE.

are likewise brass, nickel-plated. The iron soil and vent pipes from the traps which pass vertically through the room are silver bronze. They are also entirely exposed on the face of the tiled wall. As will be seen, the slab is supported on brass standards, nickel-plated. The work is so arranged that all fixtures and plumbing-work can be removed from the room in a brief period.

This work was done in the house of Mr. E. H. Wales, 122 East Thirty-ninth Street, and the master plumber was Mr. Leonard D. Hosford, 66 Beekman Street, this city.

VIOLATIONS OF THE PLUMBING AND TENEMENT-HOUSE LAWS OF NEW YORK CITY.

THE increase in the number of inspectors in the Plumbing and Tenement Bureau of the Board of Health of this

Buddensieck permit of 1884. The case was heard September 6, and Angell was held on bail to go before Special Sessions.

Another "light-and-air" case is that of O. N. Donohue, who had tenements on Fifty-Fourth Street and Avenue A. In violation of the law, which requires each house to have its own light and air court or shaft, or yard, Donohue omitted the light and air shafts, making one house to open on other lands along the East River liable to be built upon, and another on a yard of another property. He was tried on October 6, at Special Sessions, convicted, and fined \$250.

A case now pending is that of George J. Harlow, a builder of tenements at 434 West Twenty-seventh Street. Harlow, after submitting proper plans, went on to build houses, omitting the light-shaft called for in his approved

plans and specifications. He also tried to evade the law by making "alcove rooms," or one room opening from another without its proper light and air, and had other violations of the tenement law. He was arrested September 21, taken before the Jefferson Market Police Court, and held, on bail, for trial at Special Sessions.

F. Donnelly, builder of a house on Eighth Avenue and Thirtieth Street, covered the entire lot with the building, in violation of his approved plans and specifications, which called for a vacant space of four feet in the rear, to meet the requirements of law. He was notified of the violation, but proceeded with the work, claiming that the architect had told him "it was all right." He was required to take four feet off of the depth and remodel the interior of the house to satisfy the law. His trial was had October 6 in Special Sessions; he was convicted, and fined \$100, the Court, in fixing the fine, taking consideration of the fact that he had removed the violation.

Juch (or W. Meany), a builder, filed plans for a certain number of tenements on Manhattan Street. Then he built one more house than he filed plans for, hoping the inspector would not notice the fact. This house, in violation of law, he extended to the rear line of the lot, and tried to persuade the inspector that the building was to be a factory, which would not come under the tenement requirements for light and air. But the board directed the inspector to keep an eye on the building. As the work progressed, it was discovered that each floor above the first was arranged to provide for families, and Mr. Juch's case was sent to the attorney of the board. He was then notified to take ten feet off of the depth of the house, and to make other alterations required by the law. At first he tried to shift the responsibility, then made terms, made the alterations, and has not been prosecuted.

In several other cases the attempt to evade the laws has resulted in the builders incurring heavy cost for alteration. Thus in the case of houses on Norfolk Street the builder tried to outwit the board by carrying the house one story higher than his specifications showed. He had to take down a wall, enlarge the air-shaft, and remodel the interior. Again, on East Twelfth Street, a builder has been obliged to take down a wall and to make his air-shafts of the size shown on the plans. The expense involved in these changes would repay, several times over, the carrying out of the requirements of the board. These violations are virtually an attempt to gamble on the board's stupidity, and the builders have been caught and severely stuck.

Several bad violations of the plumbing regulations have also been prosecuted. Brandt Bros., for example, builders of several houses on Eighty-fourth Street, east of Avenue B, sent word to the board that the house-drains or sewers were ready for inspection. But the inspector found what he considered an intent to deceive possibly both the board and the owners. The joints of the tile-drain were properly made on top of the drain-pipes, but no joints whatever were made on the under side; supposed to be out of sight of the inspector. Had the deception not been discovered here would have been several drains leaking their filth directly into the soil. A private sewer was also badly constructed, with open joints. The board ascertained that the drains were laid by direction of the builders, who were on October 3 held in bail for Special Sessions. This case, as noted above, seems to be explainable only on the ground of criminal carelessness, rather than on the ground of a desire to save part of the expense. A lesson of responsibility is taught by the prosecution.

J. G. Collins, plumber, did the plumbing-work in four houses on Ninety-fifth Street, east of Ninth Avenue, for Taylor & Post, owners. After the work was left for finished the inspector of the board found it to be bad throughout, particularly in the imperfect joints on the cast-iron pipe and the poor quality of fittings, etc. In the cellar of one house 10 open joints were found, and in the cellar of another 8 open joints. Collins was arrested October 8, and his case is still pending before Special Sessions.

H. Z. Norton, a plumber, was arrested, as we have noted in a previous issue, for putting in dummy vents. The result was that Norton pleaded guilty, and on September 28 was fined \$250.

Francis Callaghan, of 78 Fourth Avenue, produced some remarkable joints on vertical iron pipe. A specimen was taken into court on Monday of this week, while his prosecution was going on. The Board of Health inspector discovered that Callaghan had made nominal lead joints by twisting a roll of paper, which was placed in the rear of the hub out of sight. The front of the hub was filled with what appears to be light sheet-lead, crowded in and slightly hammered. The lead was extended partly over the paper to aid the fraud. But the inspector lifted the whole thing out and Callaghan's prosecution was begun. His case was on trial October 10.

ATTEMPT TO DECEIVE A BUILDING INSPECTOR IN CINCINNATI.

THE latest trick to deceive an inspector of plumbing that has come to our notice was one attempted on Mr. Walter R. Forbush, Inspector of Buildings in Cincinnati. He was notified that the plumbing work in a tenement-house on the corner of Front and Mill Streets in that city was ready to be submitted to the water test, which our readers will understand is done by plugging up the lower end of the drainage system and filling the pipes with water to ascertain if the joints are tight. Mr. Forbush, however, found that there was no water in the pipes, and on investigation he discovered that a plug had been inserted in the soil-pipe about ten feet from its terminal above the roof. Of course, this space of ten feet above the plug was filled with water. He then broke off the back-air pipe and found it also plugged in a similar manner, the plugs being made tight with asphaltum, with the result that the drainage system was deprived of all ventilation. We regret that we do not know the name of the rascal who attempted this piece of villainy, so that we might publish it. At any rate it will be a great pity if an attempt is not made to put him in jail. If he tried it in this city we think there is little doubt but that he would find himself placed there for a short period.

EFFECT OF GALVANIZED-IRON BOILERS ON WATER-SUPPLY.

NEW YORK, September 17, 1887

SIR: Will you be kind enough to inform me whether or not it is injurious to health to drink or use for cooking purposes the water from a galvanized hot-water boiler such as are used in flat-houses? YOUNG PLUMBER.

[Under ordinary circumstances, and with the Croton water-supply, there is no danger in the use of water from a galvanized-iron boiler. The zinc is slowly dissolved, and the quantity in the water at any one time is so small as to be harmless. With a new boiler, in which the water has stood for several days, enough zinc may be dissolved to give a perceptible taste, and such water would probably be injurious.]

It is always a wise precaution to let all the water run to waste which has been standing in water-pipes and boilers for a week or more before drawing water for drinking or cooking, because water which has thus stood in the pipes is apt to contain both lead and zinc.

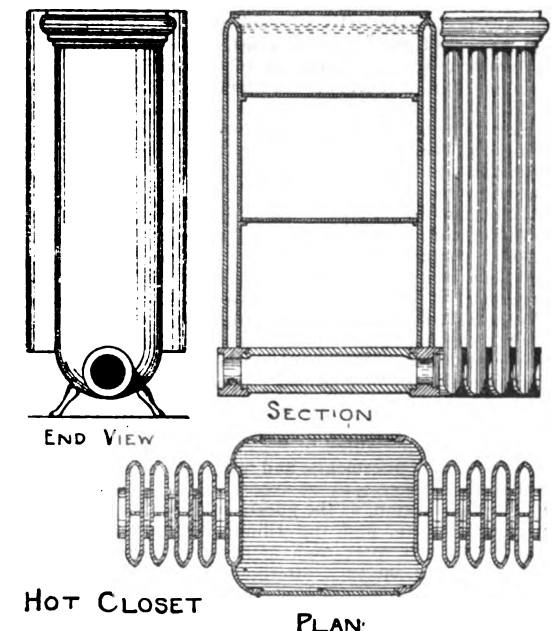
With some water-supplies the corrosion of galvanized-iron pipes, boilers, etc., is very rapid for the first three or four days.]

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

RADIATOR HOT CLOSET.

THE accompanying drawings illustrate a novel hot closet or dish-warmer for use in dining-rooms or butler's pantries



lately invented and patented, George H. Dixon, steam-heating engineer, of Chicago, Ill.

The invention constitutes a hot closet or dish-warmer by itself, heated by the circulation of steam or hot water through its end parts, and also through its bottom, independently of any radiator tubes or other exterior mechanism. The hollow vertical end sections or elements are connected at their lower ends by ordinary screw-joints to the hollow base N, and where desirable they may be connected with radiator tubes at their top ends, in such a case being capped in an ornamental style, as shown, being substantially a radiator and hot closet combined.

The curved plates serve to make the closet of suitable width, and also as connecting-plates for the back and front door plates.

Shelves to the closet rest on projections formed on the insides of the side tubes, and on top there is a plate covering the closet. Steam when used enters the hollow base through the pipe connecting the radiator with the closet, and the water of condensation is discharged at the opposite end in the usual manner; or one of the openings may be plugged up and the steam enter and the water of condensation return through one and the same pipe under the ordinary single-pipe system of steam circulation.

When hot water is employed as the heating medium, the end sections of the closet must be connected at their tops by one or more small tubes, as shown by dotted lines, to attain a proper circulation of the water.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

STREET-SWEEPING MACHINES WANTED.

BOARD OF HEALTH OF THE CITY OF ATLANTA,
OFFICE OF SECRETARY, 63 WHITEHALL STREET,
ATLANTA, GEO., October 7, 1887.

SIR: Will you kindly give me the address of several reliable manufacturers of street-sweeping machines if it is in your power to do so? Yours truly,

JAMES B. BAIRD, Secretary.

[Referred to our readers.]

EFFECT OF BOWER-BARFF PROCESS ON WATER-PIPE.

SIR: Is it absolutely safe to use Bower-Barff process rustless iron pipe for the water-supply of a house for drinking and all other purposes? I am thinking of so using it, but know very little about it. HOUSE-OWNER.

[We think so.]

NORFOLK SEWER SYPHON.

OFFICE CITY ENGINEER,
NORFOLK, VA., October 4, 1887.

SIR: My attention having been called to your notice of the last municipal report of this city, I beg permission to correct what is, in my opinion, an injustice (unintended, of course) to Colonel George E. Waring, Jr., whose system of sewerage has been adopted here.

The syphon therein mentioned was not "an improvement on Colonel Waring's original plan," as the discharge of sewage by gravity is certainly better than where gravity has to be assisted. It was a change necessitated by peculiar surroundings. It is due Colonel Waring, also, to state that the use of the syphon was suggested and recommended by him. Very respectfully,

W. T. BROOKE, City Engineer.

PLANT MILLING CO. BOILER EXPLOSION.

NEW YORK, October 11, 1887.

SIR: Some of the newspaper articles on the explosion at the Plant Milling Co. contained statements which would lead people to believe that the Babcock & Wilcox boiler may have exploded. Will you kindly give a place in your columns to the following, as it will serve to correct mis-statements, and oblige, very truly,

THE BABCOCK & WILCOX CO.

"The 'Firmenich' boiler at the mill of the Plant Milling Co., St. Louis, exploded October 3, destroying the boiler-house and wrecking the Babcock & Wilcox boiler by its side. As soon as the debris could be cleared away, and the facts investigated, a telegraphic order was sent to the Babcock & Wilcox Co. for two new boilers of 500 horsepower."

hemlock beams were above, but, so far as examined, show little or no indication of decay.

Whether this superior durability is owing to a difference in the nature of the timber, or to the longer seasoning that the spruce beams had received before being sealed up, cannot yet, if ever, be definitely known.

The character of the parties interested is such as to render it certain that the whole matter will receive a most searching and scientific investigation, but, meantime, enough is known to be a most valuable warning to any one proposing to use a similar construction.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Ketchikan Gas-Light Company.	Equitable Gas-Light Company.
October 8,	25.16	20.88	21.76	29.47	31.00	23.27	29.76

E. G. LOVE, Ph.D., *Gas Examiner.*

THE heating and ventilating of the new building of the "Vereins Bank," in Munich, Bavaria, is the subject of an interesting paper in the *Gesundheits-Ingenieur*, by Dr. Frederick Renk. The paper is most interesting, because the building has been erected with the idea of embodying and completing in every way modern German ideas on these two most important subjects—heating and ventilation.

THE last number of the *Revue Industrielle* contains three rules, promulgated by the Committee of Public Health for France, relative to and specifying the colors that may and may not be used in the painting and decorating of children's toys. All arsenical colors and lead salts soluble in water are forbidden. Chrome yellows and similar compounds when used under varnish or with alcohol are permitted.

AT a meeting of the Gas Committee of the Glasgow Corporation, held on the 25th ult., it was agreed to recommend the Town Council to reduce the price of gas in the city, and also to outside consumers from 3s. to 2s. 10d. per 1,000 cubic feet. This is the third reduction in the price of gas which has been made during the last four years.—*Gas and Water Review.*

ACCORDING to the *Electrical World*, Mr. E. P. Thompson has devised a form of incandescent electric-lamp in which means are provided for preventing the disposition of carbon particles on the inner surface of the globe.

AMERICAN INSTITUTE OF ARCHITECTS.

THE twenty-first annual convention of the Institute will be held on Wednesday, Thursday, and Friday, October 19, 20, and 21, 1887, at Chicago, in the rooms of the Literary Club, in the Art Institute, corner of Michigan Boulevard and Van Buren Street.

The following is the order of proceedings:

First Day, Morning Session, 10 A. M.—(1) Opening address, by President Thomas U. Walter, LL.D., or, in his absence, by First Vice-President Edward H. Kendall; (2) Report of the Board of Trustees; (3) Report of the Treasurer, and appointment of Auditing Committee thereon; (4) Reports of the Standing Committees on (a) Education and (b) Publications; (5) Reports of the Chapters in Baltimore, Boston, Chicago, Cincinnati, Indianapolis, New York, Philadelphia, Rhode Island, San Francisco, St. Louis, and Washington; (6) Report of the Secretary for Foreign Correspondence; (7) Appointment of Nominating Committee for the election of officers and standing committees for the ensuing year; (8) Reports of special committees: (a) On bill to provide improved methods in the architectural service of the Federal Government; in conference with Special Committee of the Western Association of Architects; (b) On Architects' Protective Associations; (c) On providing a permanent home for the institute; (d) On a building contract for use throughout the United States; in conference with Special Committee of National Association of Builders, U. S. A.; (9) Appointment of special committee for the consideration of all reports presented to the convention; (10) Communications, announcements, and miscellaneous business.

Recess.

The Convention, as the guests of the Chicago Chapter of the Institute, and the Illinois State Association of Architects, will, after each morning session, take lunch together; and, on such afternoons as may be announced at the first session, their hosts will drive them to points of architectural interest in the city and its vicinity.

Evening Session, 8 P. M.—Exhibition of illustrations of work executed, within the last ten years, by such practitioners as may have responded to the official invitation to

letter of 1st ultimo, to Institute Fellows and Associates, to whom it is herewith re-enclosed.

Second Day, Morning Session, 10 A. M.—(1) Unfinished Business; (2) Amendments to By-Laws; (3) Report of Nominating Committee; (4) Report of Special Committee, for the Consideration of Reports; (5) Election of Officers and Standing Committees; (6) Reading and Discussion of Papers. The following papers, among others, on themes suggested to the authors, have been promised; and several are already in the hands of the Committee of Arrangements: By Mr. D. Adler, Fellow, on "Theatres." By Mr. M. E. Bell, Fellow, late Supervising Architect of the U. S. Treasury Department, on "The National Building Question." By Mr. W. W. Boyington, on "Differences Between the Methods of Architectural Practice Prevalent Now and Fifty Years Ago." By Mr. D. H. Burnham, Fellow, on "Suggestions toward the best and speediest methods for harmonizing and utilizing all the architectural societies in the United States, so as to secure the most good for architecture, for the public and for the profession in America; due regard being had, as concerns means, alike to individual energy and enthusiasm, and to associative experience; and, as concerns ends, alike to local sentiment and to national reputation." By J. C. Cady, Fellow, on "Opera-Houses." By Mr. Charles H. Harn, on "Manual Training as Applied to the Building Arts." By Mr. John Moser, Fellow, on "Federal Buildings for Judiciary, Customs and Postal Service." By Mr. J. L. Smithmeyer, Fellow, on "Library Buildings." By Mr. J. M. Wilson, Fellow, on "Where the Line of Demarcation Between Engineering and Architectural Practice is to be Found." (7) Communications, Announcements, and Miscellaneous Business.

Recess. Lunch.

Evening Session, 8 P. M.—(1) Unfinished business; (2) reading and discussion of papers continued; (3) communications, announcements, and miscellaneous business.

Third Day, Morning Session (only), 11 A. M.—(1) Unfinished business; (2) reading and discussion of papers concluded; (3) miscellaneous subjects and discussions; (4) general business, communications, announcements, resolutions of thanks, and adjournment.

The committee announces that there are two eligible hotels—on the European plan—in the immediate vicinity of the convention's place of meeting; one the Leland Hotel, Michigan Boulevard, corner Jackson Street, where rooms may be had from \$1.50 per day upwards; the other, the Richelieu Hotel, Michigan Boulevard, between Jackson and Van Buren Streets, where luxurious quarters may be had at from \$2.50 to \$20 per day.

Visiting members will find, at the meeting-room of the convention, a visitors' book, in which they are particularly requested to register, promptly on arrival, their addresses both at home and in Chicago; residents of Chicago will also please register.

Although, owing to the impossibility of getting the promise of attendance at the Institute conventions in sufficient numbers, as well as to the widely separated points from which members—often but a single individual from one place—start for the point of meeting, it has hitherto been found impracticable for the successive committees of arrangements to secure a general system of reduced rates for railroad travel; it is nevertheless suggested—and it has indeed been found feasible in several cases heretofore—that, if the various chapters, each in its own locality, will organize a visiting delegation to the convention, they may, through their local business and social connections, induce the railroad officials, in their several places of residence, to reduce rates for a dozen, or even for half a dozen friends or acquaintance to a figure which would be refused to an isolated individual, and a proposition for which, unless on the understanding of tickets being taken by the hundred, as usual where conventions are concerned, would receive no attention whatever if made by a distant Committee of Arrangements.

All reports or communications for the Committee of Arrangements should be mailed to the Secretary, A. J. Bloor, 18 Broadway, New York, or they may be forwarded direct to Mr. Henry Lord Gay, 15 East Washington Street, Chicago. He will also, on account of the Institute, receive illustrations for the exhibition hereinbefore mentioned, and an invoice thereof should be mailed to him.

W. L. B. Jenney, E. T. Littell, Henry Lord Gay, A. J. Bloor, Committee of Arrangements.

PERSONAL.

PROF. CHARLES F. CHANDLER, Dean of the Faculty of the School of Mines, Columbia College, New York, has just returned from Europe.

MR. E. H. WALKER, for many years Statistician of the New York Produce Exchange, has joined the editorial staff of *Bradstreet's*, to which paper he will give his exclusive services.

GEORGE B. BURBANK has been assigned as Division Engineer in charge of the Sixth Division, New York New Croton Aqueduct, consisting of the East Branch Reservoir and the Sodom Dam and Reservoir.

MR. H. W. BRINCKERHOFF, M. Am. Soc. C. E., has accepted a position on the editorial staff of THE ENGINEERING AND BUILDING RECORD. This notice is repeated, as the initials were accidentally transposed in our last issue.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

NEW YORK CITY HALL ADDITION.

The Board of Sinking Fund Commissioners of New York City have adopted a resolution calling for competitive plans for a new building to accommodate the municipal departments and the criminal courts. Plans are to be submitted before March 1, 1888, and the following premiums are offered: First, \$5,000; second, \$4,000; third, \$3,000; fourth \$2,000, and fifth, \$1,000.

The building is to be six stories high in the form of two wings, one fronting on Broadway and the other on Park Row, leaving the space in the rear of the present City Hall as an open court with provision for free passage at the four corners.

Plans embodying the views of the committee have been prepared by Major McLean, City Engineer.

The Park Row wings will front 191 feet on Park Row and to be 180 feet deep, and will contain 10,770 square feet of room space. The Broadway wings will front 220 feet on the street, be 160 feet deep, and have 15,143 square feet of rooms.

Competitive plans must give the elevation of the proposed wings on each of the four sides and on the inner court, and must be accompanied by floor plans and specifications, with an estimate of cost. The Sinking Fund Commissioners are to be the judges of the plans, but the acceptance of any plan does not insure the employment of its designer as architect.

Lithograph copies of the general plan will shortly be prepared.

BRANTFORD, ONT.—The City Corporation ask architects to submit plans for a House of Industry and Refuge for ninety inmates, with barn, etc. The premium is \$50. Address S. Hewitt, Chairman of the Competition.

SCHOOL-HOUSE PLANS.—Architects of New York State are invited to submit competitive plans for six school buildings, for which \$975 is offered in prizes. The time of competition limited to December 1, 1887. Address A. S. Draper, State Superintendent, Albany, N. Y.

TRADE CATALOGUES.

THE DEANE STEAM-PUMP COMPANY, of Holyoke, Mass., has just issued a handy little catalogue describing and illustrating the various forms of steam-pumps manufactured by them and also quoting prices. The book contains in addition some useful information accompanied by several tables, showing "areas of circles," "friction of water in pipes," "probable thickness, weight, dimensions, etc., of cast and wrought iron pipes," etc.

We have received from Messrs Rutzler & Blake, 176-178 Centre Street, New York, their illustrated price-list for 1887 of "Improved Steam Specialties."

CHARLES MILLER & SON, lead pipe manufacturers, have issued a little catalogue in which the section of each size and weight of lead pipe is lithographed, full size, from 1/4 to 2 inches.

We have just received from the New York Iron Roofing and Corrugating Company, 115 Broadway, New York, their illustrated catalogue for 1887.



For works for which proposals are requested see also the "Proposal Column," pages 537-543-544.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE. ETC.

MINNEAPOLIS, MINN.—Bids recently opened on pumping-engine for North Minneapolis. The Water Committee has referred them back to Council.

MINNEAPOLIS, MINN.—City Council has extended the time for receiving bids on pumping machinery forty days. The action was taken October 7.

LANCASTER, PA.—The contract for erecting the new building for the water-works has been given to Amos S. Urban, of that city, at \$17,750.

After awarding the contract for water-works to Amos S. Urban at above price (\$18,750) he informed the Council Committee that he had made a mistake in his computations, and the bid was lower than he had intended it to be. City Council at once decided to readvertise.

GREENBUSH, N. Y.—Messrs. Landreth, Fitzgerald & Prescott, of Schenectady, have finished the plans for the Greenbush sewers, and have presented them to the village fathers. The cost of the system complete will be about \$70,000.

BURLINGTON, VT.—A main sewer will be built at once in King Street.

GLENWOOD SPRINGS, COL., will have water-works completed by November.

SEVILLE, FLA.—The sewerage system is being extended.

MARBLEHEAD, MASS.—The water-works at Marblehead that have been tried and proved to be inadequate for fire purposes, will be remedied by the company putting in a larger main. The town will also consider at an early day the extension of the water works throughout the town, affording a supply for both fire and domestic purposes.

JERSEY CITY, N. J.—Another water-supply proposition was received by the Board of Public Works, October 11, from George H. Titcomb, who offers to deliver water at Belleville at the rate of \$32 per million gallons. He claims that he is able to build a \$5,000,000 plant within fifteen months. He says the city may purchase the plant any time within ten years at the cost of construction plus five per cent. The matter has been referred to the Committee of the Whole.

MILWAUKEE, WIS.—See our Proposal Column for information regarding pumping machinery wanted at this city.

BOWLING GREEN, O.—Our correspondent writes: "The vote to authorize the operation of water-works in the village of Bowling Green, O., resulted as follows: for, 179; against, 163; majority for, 16. Only a light vote was polled."

EL PASO, TEX.—El Paso is at present constructing a sewer system according to plans and under the superintendence of George Waring, C. E. The sewage of the city is intended to be discharged into the Rio Grande at a point a short distance below the city limits. The work is progressing rapidly and will soon be finished.

NORTH EASTON, MASS.—Our correspondent writes: "Village District of North Easton has appropriated \$75,000 to build water-works. Works are half completed. About six miles pipe, sixty hydrants, stand-pipe and large collecting-well, yielding a very pure, soft, spring water. Works will be in commission December 1, 1887."

PONTIAC, MICH.—Our correspondent writes: "A special election held and \$75,000 voted for construction of water. No definite action further than the appointment of a Board of Water Commissioners has been taken."

LOWELL, MICH.—The Lowell Water Company, previously noted, is progressing towards giving the village a supply of water. The company is composed entirely of Grand Rapids capitalists. They are putting in a system on the reservoir plan. The reservoir is located on the hill, north-east of the village, and has a capacity of nearly 1,000,000 gallons. The water will be obtained from twenty tubular wells. Their average depth is twenty-five feet. The pumping-engines to be used are of the Smith-Vaile duplex pattern. Four miles of pipe will be used.

ALTOONA, PA.—The Water Commissioners ask that \$25,000 be offered to lay a water-main to Kittanning Reservoir.

TORONTO, ONT.—Superintendent Hamilton, of the water-works, has prepared for the Aldermen a new plan for increasing the water-supply. It provides for additional 4-foot iron mains, to connect the pumping-station with the 6-foot main.

MILWAUKEE.—The Common Council, at its next meeting, will instruct the Board of Public Works to advertise for bids to construct the flushing-tunnel under Dane Place.

OMAHA, NEB.—Our correspondent writes: "Our town ranks as a metropolitan city of 100,000 inhabitants. We have had water-works in successful operation since 1881. The company are at present enlarging their facilities. The works are not under control of the city government."

STROMSBURG, NEB.—Our correspondent writes in regard to water-works: "Bids to be open for a \$12,000 system on October 15."

FORT COLLINS, COL.—In regard to the rumored construction of water-works here our correspondent writes that "the works were completed and have been in good working order since 1883." C. B. Parsons is water-works superintendent.

CHICAGO.—City Engineer Artingstall has about completed plans for the 4-mile tunnel, eight feet in diameter, for new water-works, the tunnel to start from the Lake Park on the South Side. The site for pumping-works is not yet chosen. The improvement, it is popularly estimated, will cost \$1,500,000.

WEST DEPERE, WIS., will have a system of water-works.

SALT LAKE CITY, UTAH.—City Council is considering plans for sewerage.

NEW ORLEANS, LA., is receiving bids on artesian wells for water-supply; from the American Well-Drilling Company, of Louisville, Ky., for example.

NEW ORLEANS, LA.—The City Surveyor will prepare plans for work on certain of the canals and levees. It is expected the work will be done before the winter rains set in.

MOBILE, ALA.—The Common Council held a meeting October 7 for the purpose of considering the Bienville Water-Supply Company's proposition to furnish 100 fire-hydrants, to be located by the Chief of the Fire Department, for one year at \$50 each. The ordinance was amended by putting the power of locating the hydrants in the hands of the Street and Fire-Engine Committee and the Chief Engineer of the Fire Department, instead of the Chief solely, and, as amended, was adopted.

WEST HARTFORD, CONN.—A committee has been appointed to consider sewerage for the West Side. Address the Town Clerk.

GLASTONBURY, CONN.—Yesterday a meeting was held at the Town Hall to devise more perfect meadow drainage. Address the Glastonbury Meadow Drain Company.

GRIFFIN, GEO.—Our correspondent writes: "No steps have been taken as yet, except the sanction of the State Legislature, to assess a special tax for this purpose. Before the system can be inaugurated a two-thirds majority vote of the citizens will be necessary. No date has been fixed for this election, though I think it will be early in December."

HUMMELSTOWN, PA.—Our correspondent writes: "The Town Council has agreed to accept sixteen plugs at \$35 per annum for ten consecutive years. The works are to be completed April 1, 1888."

MONTREAL, CAN.—City Council has approved the reports of the Water Committee recommending the appropriation of \$67,000 for high-level pumping apparatus and water-mains.

SYRACUSE, N. Y.—Common Council has ordered the construction of a 60-inch brick sewer in Crotton and other streets to Onondago Creek, at an estimated cost of \$26,000. Address H. W. Bannister, City Clerk.

GALLATIN, TENN.—Our correspondent writes: "Nothing on our prospective water-works at present; will be nothing done about it for six or eight months."

JOHNSON CITY, TENN.—The City Council has made arrangements to put up water-works here, and to commence in the next ninety days, but has done nothing yet. Time will be up in November.

LAKE CITY, FLA.—Our correspondent writes: "A charter has been granted to Noyes S. Collins for twenty-five years to construct and maintain a water-supply for this town. He has already begun operations, using present works, but will enlarge."

SHELBYVILLE, ILL.—The Shelbyville Water Company increases its stock from \$7,000 to \$100,000.

KALAMAZOO, MICH.—In our Proposal Column will be found a reference to the construction of a well for the water-works.

WINONA, MINN.—On October 4 Council voted to purchase a 2,000,000-gallon pumping-engine, and to ask bids for sinking a large well.

FOSTORIA, O.—Our correspondent writes: "As yet there has been no definite action had in reference to water-works. An ordinance has been passed granting franchise, which must yet be ratified by a vote of people, and the special election has not been called, and will not be had until some minor matters have been arranged with the contractors, and until they file an acceptance as provided for in ordinance. Can, therefore, not give you any definite information."

UNION GROVE, WIS.—Our correspondent writes: "We are only boring artesian wells for fire protection. We have let the boring of the same to Gray Gray Brothers, of Milwaukee, Wis., but we have done nothing regarding pipes and hydrants as yet."

ST. ANDREWS, N. B.—We call attention to the construction of water-works here. See our Proposals.

CLINTON, ILL.—At a special meeting of the City Council, October 4, the contract for supplying the water-works with pipes, special castings, hydrants, gates, and pumps was let, and will involve an expenditure of about \$6,000. The complete system will require about \$10,000. The cost of the well, which is now finished, was \$3,000.

CORSICANA, TEX.—\$25,000 will be spent on sewers and other works.

MACON, GEO.—It is proposed to spend \$60,000 on sewers, etc.

ONEIDA, N. Y.—Surveys are being made for sewers. Address the Town Clerk.

GALLIPOLIS, O.—Our correspondent writes: "The Council of this city have passed an ordinance submitting the question to a vote of the people, as to whether the Council shall issue bonds to the amount of \$50,000 for the building of water-works. The vote will be taken on November 8."

KINSLEY, KAN.—The contract for construction of water-works for city of Kinsley, to cost about \$40,000, was let to D. Mitchell & Co., Dodge City, Kan., September 20, works to be completed by January 1, 1888. Will use the stand-pipe system. Contract calls for two duplex pumps of 750,000 gallons capacity each. Work will be begun immediately.

BAR HARBOR, ME.—C. H. Eglee, of Flushing, N. Y., has been awarded contract for laying water-pipe of the Eden Water Company, about eleven miles, varying in size from 6 to 24 inches. E. W. Bowditch, C. E., of Boston, being the engineer of the work to be done there.

DAVID CITY, NEB.—Our correspondent writes: "The city of David City, Butler County, Neb., has voted \$22,000 in 'water bonds,' which are now for sale, for the construction of a system of water-works. The contract has been let to a contractor of Columbus, Neb., and is to include Cook's patent tube wells (27-inch) and hydrants. The stand-pipe will be 110 feet in height; direct-pressure engine in connection with stand-pipe. About three miles of mains are to be completed by December 31. Plans and specifications were furnished by A. A. Richardson, of Lincoln, Neb. The contractor expects to commence work within ten days."

NEW ROCHELLE, N. Y.—Our correspondent writes: "This town is to be supplied with water by the New Rochelle Water Company which the capital stock of is almost entirely owned by A. Iselin, Sr. The reservoir is already built and the pipes are all laid throughout the village; and a commission which was appointed to assess damages for laying the pipe through some farms from the reservoir have filed their report, and the main pipe will be laid immediately, so we shall have water in the spring or before."

TOWSONTOWN, MD.—Incorporated is the Consumers' Water and Illuminating Company, of Baltimore County, to supply water and gas to the towns of Woodberry, Woodlawn and Hampden. The directors are J. D. Mallory, R. J. Capron, W. M. Busey, George B. Morton, and William H. Watkins.

HELENA, MONT.—The Iron King Water Company is incorporated by Frank Tibbals and others.

RUSHVILLE, NEB.—Our correspondent writes: "Our village has contracted for the construction of a \$3,500 system of water-works, with the U. S. Wind-Mill and Engine Company of Omaha, to be completed by December 1, 1887, for fire protection and domestic use. We have 1,500 inhabitants, is the county seat of Sheridan County, and are constructing a \$5,000 school-house. The town dates from August 15, 1885, and promises to be one of the leading towns of north-western Nebraska. The Government freight-house for the Pine Ridge Indian Agency is located here. The Board of Trade is figuring with Eastern firms with a view of starting a cracker factory, a starch factory, and cigar factory here. We have a steam-roller, flour-mill, 200-barrel capacity, two brick-yards, and a boom."

ESSEX, VT.—Town meeting to-day votes on raising funds for village improvements.

KEWANEE, ILL.—Our correspondent writes: "The laying of water-pipe is nearly completed and the well will be finished in two weeks. Expect to furnish water December 1, 1887."

KEOKUK, IOWA, has decided to expend \$75,000 in a system of sewers.

BOSTON.—The Aldermen have refused to vote the \$100,000 asked for by Mayor O'Brien for new sewers.

COLDWATER, MICH.—Mr. Mason L. Brown, Civil Engineer, of Detroit, has completed plans for a system of sewerage and water-works for this city. Work to begin next year.

GRAND RAPIDS, MICH.—T. A. Parrish, of Grand Haven, has proposed that a pipe-line be laid to Lake Michigan to supply Grand Rapids with water.

JERSEY CITY, N. J.—The Board of Aldermen will have a hearing on plans for water-supply at the City Hall, Tuesday, October 17.

GREENVILLE, MICH.—This town has voted to bond itself for \$25,000 for water-works.

EAST TAWAS.—It is stated that the water-works here will be built by the Michigan Pipe Co., of Bay City, for \$28,000.

WATER COMPANY.—The Colorado City Water Company has filed articles of incorporation. Anthony Bott, Jacob Becker and John Campbell are the incorporators. Water is to be taken from Sutherland Creek, in El Paso County. The capital is \$200,000.

MORRISON, ILL., will have water-works.

MACHIAN, ME.—P. Rose, hydraulic engineer, has reported on water-supply. He favors either Lily Lake or two spring streams, with pumping-works and a dam at Lily Lake, to create a reservoir with a capacity of 22,000,000 gallons.

HOLMES CITY, COL., will have a water-supply from a flowing well.

EUPAULA, ALA.—Work has been begun on the water-works plant for this city.

CHARLOTTE, N. C.—The contract with the water-works company for erecting works here has been annulled, and the city has instructed the committee to advertise for new bids. Address F. B. McDonnell for particulars.

CARPENTERIA, CAL.—Our correspondent writes: "There is a regular chartered water company—Carpenteria Water Co.—at this place, but owing to litigation it has not done a great deal toward distribution; will do so shortly."

MACHIAS, ME.—In regard to water-works our correspondent writes: "No action yet by the town. Citizens are working by committee to report hereafter."

BROOKFIELD, MASS.—Our correspondent writes: "At town meeting of October 4 the town voted to put in water for fire purposes. A committee was also chosen who are to make a report at an adjourned meeting to be held Saturday, October 15, in regard to best means of obtaining the water, estimated expenses, etc. They will probably put in water for other purposes besides fire."

HENDERSONVILLE, N. C., contemplates building water-works.

AUSTIN, TEX.—A permit has been applied for by Silvester Watts and others for the purpose of building gas, water and electric light works.

WEATHERFORD, TEX.—The Weatherford Water, Ice and Light Company has been incorporated; capital stock, \$500,000. R. W. Kindel, R. F. Starr, S. Newmeyer, D. C. Haynes, R. R. Coleman, Henry Warrell, and Boyd Porter, incorporators.

MANCHESTER, VA.—A proposition has been made by Messrs. Ferris & Holladay, of Jersey City, to build water-works. The Finance Committee are considering the erection of a water-tower with a capacity of 500,000 gallons.

LAKE, ILL.—Proposals for pumping-engines were opened by the Town Trustees October 4. Up to the 11th inst. no definite action had been taken. We have not yet been able to obtain the bids.

ANDERSON, CAL.—A system of water-works will be erected here by the Anderson Water Co.

CHARLESTON, W. VA.—The Charleston Water-Works Company are building a filtering-basin 25x50 feet.

FAYETTEVILLE, N. C.—Proposals will be received until November 1 for building water-works. Address F. R. Rose, Fayetteville, N. C.

BLOUNTSVILLE, ALA.—Messrs. Doyle & Hudson, of this city, want 1,800 feet of 1½ or 2 inch water-pipe.

GAS AND ELECTRIC-LIGHTING.

BRAINARD, MINN., was illuminated with electric-lamps October 4.

LOUISVILLE, KY.—The Enterprise Natural Gas Company is developing a plant, and has struck gas at its well on Third Street. Mayor W. H. Coen is President, Harry Weissinger, Vice-President.

HARTFORD, CONN.—The question of street-lighting has not yet been settled. A report from the committee was received on the 10th inst., and ordered printed. It will come up for action at the next meeting. Immediate attention is desirable.

MIDDLETOWN, CONN.—The Schuyler Electric-Light Company will remove its works to Middletown, from Hartford. Works will be built.

ONALASKA, WIS., will have gas-lighting, taking the gas from the La Crosse works.

PHILADELPHIA.—The Columbia Natural Gas Company, developing wells and plant near Bradford, has passed into the control of the Natural Gas Trust of Philadelphia. James E. Salter, of Philadelphia, is President of the Columbia; James Miller, of Franklin, is Secretary.

FREDONIA, KAN., will have electric-lights, using the Thomson-Houston electric-light system.

HOULTON, ME.—The plant of the Thomson-Houston Electric-Lighting Company has been purchased by citizens, to be transferred to the water company.

CLEARFIELD, PA.—A company has been formed to sink gas-wells and erect a plant.

JERSEY CITY, N. J., wants better street lighting. Address the City Clerk.

FALL RIVER, MASS.—After to-day there is no appropriation for continuing the lighting of the streets, and new arrangements, both for gas and electric lighting, will have to be made.

PHOENIX, N. Y.—A special election is called for October 18 to determine whether the taxpayers are willing to accept the proposition of the Electric Light Company to furnish twenty arc lights one year for \$1,000.

AUSTIN, TEX.—The City Council has granted authority to the Austin Water, Light, and Power Company to erect poles and maintain electric-lamps.

KANKAKEE, ILL.—Incorporated is the Kankakee Electric Company by W. S. Read, J. H. Searer, and others.

STOCKTON, CAL., wants bids on street-lighting. See our Proposals.

PHOENIX, N. Y.—The contract for lighting the streets of Phoenix has been submitted to the Village Board. The company agrees to put in six more lights, making in all twenty, for \$1,000 a year.

AMSTERDAM, N. Y.—The Amsterdam Common Council has decided to erect 67 arc-lights of the Thomson-Houston electric system in the streets. The cost is \$6,683.25 per year for 67 lights of 1,200 candle-power each.

ST. PAUL, MINN.—City Convention, October 7, passed the ordinance granting to the National Subway Company authority to lay underground conduits for electric wires.

ELIZABETH, N. J.—Street Committee has recommended that the Westinghouse Electric-Light Company be granted a franchise. The other competitor for the street-lighting is the Schuyler Electric-Light Company.

MIDDLETOWN, O.—The Middletown Gas Company is incorporated.

LEAVENWORTH, KAN., parties have contracted with a Mr. Reed, of Ohio, to sink a gas-well 3,000 feet; price, \$10,000. Boring has just been begun, and it is expected that by January 1 the plant will be well completed.

LIMA, O.—Much gas-pipe will be needed to lay the distribution of natural-gas supply, which has just been carried to the city from the gas-fields. Address the City Engineer for further information.

NEW ORLEANS, LA.—Council has authorized Mayor J. V. Guillotte to contract with the Louisiana Electric-Light Company for five years to light the public buildings.

HUDSON, WIS.—S. H. Pierce, proprietor of the Hudson electric-light plant, has made a proposition to the City Council to light the principal streets. The proposition will be accepted.

FARMINGTON, ME.—The Dirigo Gas-Light and Heat Company of Maine, has been organized. Directors, Franklin J. Clark, B. M. Hardy, John J. Linscott, Seth E. Beedy, and Arthur E. Beedy. The purpose of the company is to furnish gas-light and heat by means of gasoline. Address the President, Dr. J. J. Linscott.

ORANGE, N. J., is still undecided about the granting of franchises for electric lighting. The matter is now referred to the Street-Lighting Committee. Address Mayor Hartford. Immediate attention is necessary.

ST. LOUIS, MICH.—Colonel John A. Elwell and others have formed an Edison Electric-Light Company.

CHICAGO.—People's United Gas Construction Company of Chicago; capital stock, \$100,000; to manufacture and sell gas for illuminating and heating purposes; incorporators, Elias Beach, Ezra Seaver, and E. D. Clark.

BALTIMORE, MD.—The Baxter Electric Motor and Manufacturing Company have purchased ten acres of land and will build new works.

MACON, GEO.—The Jeter and Boardman Water and Gas Association have been chartered, with capital stock of \$50,000, for the purpose of building and operating gas and water works and electric-light plant. The incorporators are W. A. Jeter, of Brunswick; J. S. Schofield, of Macon; J. W. Wilcox, and James H. Campbell, of Macon.

LAKE CITY, FLA.—N. S. Collins will erect an electric-light plant for street-lighting here. Address him at the Lake City Bank.

JACKSON, TENN.—The Citizens' Electric-Light Co. of this city will erect a plant.

WEST CHESTER, PA.—Council has awarded the contract for lighting the streets to the Electric-Light Co. at \$15 per lamp per annum, for three years.

ALBINO, ORE.—Address C. B. Belling and Joseph Paquet in regard to electric-light plant to be erected here.

LAKE, ILL.—The bond of Economic Light and Heat Gas Company has been filed, and the company will supply gas.

STEAM-HEATING, BUILDINGS, ETC.

OYEMAW COUNTY, MICH., will vote on bonding for \$20,000 for county buildings.

STANTON COUNTY, NEB., will vote on raising money to build a jail.

JERSEY CITY, N. J.—A contract was signed October 6 for the rebuilding of the U. S. Express stables, corner of Henderson and Eighth Streets. The contractor is Charles Bouton, of New York. The building will cost about \$90,000. The plans and specifications were prepared by architect Lewis H. Broome, who will have supervision of the work.

LOUISVILLE, MISS.—Proposals are out for constructing a Court-House.

APPONANG, R. I.—Steam-heating apparatus is wanted by the Town Council (Warwick) for the Town Asylum. Bids will be received until October 24. Address the Town Clerk at Warwick.

BUILDING IRON WORK.—Among the proposals for the County of Duval County, Fla., are those for the iron work. See our Proposal Columns.

JACKSONVILLE, FLA.—On October 8 the Merrill-Stevens Engineering Company filed articles of incorporation. This company is composed of Messrs. A. D. Stevens, President; H. C. Pike, Secretary; W. L. Lamkin, Treasurer; Eugene Merrill, Manager of the Forging Shop, and Alexander Merrill, Manager of the Boiler Shops. Buildings will be erected and machinery is wanted.

CANON CITY, COL.—Chief Engineer A. A. Robinson, Santa Fe R. R., has located the passenger depot at the foot of Fourth Street, and the freight depot foot of Third Street. The buildings will be erected at once and stockyards also constructed.

CHATTANOOGA, TENN.—The newly incorporated Emory Coal and Railroad Company will develop a large property near this city—coal mines, railroads, buildings, gas-plant, etc. Incorporators: J. H. Parker, Paul R. Albert, W. J. Willingham, and others.

ST. PAUL.—After a municipal contest of six weeks the contract awarded to A. O. Noepel, of Des Moines, Iowa, for steam-heating the new City Hall and Court-House, and which failed of confirmation last week, has been confirmed by a joint meeting of the City Council and Court House Commissioners.

BRIDGES.

BRIDGE.—An iron bridge will be built over Middle Creek, Tremont Borough, Pa. Address proposals to John Healy, Commissioner of Schuylkill County, Pa.

HARRISBURG, PA.—City Council has appointed a committee to confer with the Pennsylvania Railroad in regard to the construction of overhead bridge in the city of Harrisburg.

FOND DU LAC, WIS.—The following bids for an iron bridge on Arndt Street were received by the Common Council of said city, October 3:

E. A. Spalding, Dubuque, Iowa, \$710.
King Iron Bridge and Manufacturing Company, Cleveland, O., \$1,075, with iron piers.
Kansas City Bridge and Iron Company, four plans—plan A, \$695; B, \$689; C, \$635; D, \$600.

Wisconsin Bridge and Iron Company, two plans—A, \$650; B, \$590.

Groton Bridge and Manufacturing Company, four plans—plan A, \$585; B, \$700; C, \$780; D, \$875. The three latter plans contemplate iron joists.

A. Y. Bayne & Co., of Minneapolis, three plans, designated by weight, at \$600, \$645, and \$695.

Massillon Bridge Company, Massillon, O., two plans—No. 1, \$550; No. 2, \$580.

Wrought-Iron Bridge Company, Canton, O., four plans—A, \$625; B, \$567; C, \$500; D, \$465.

Milwaukee Bridge and Iron Works, presents two plans, both same price, \$620.

P. E. Lane, Chicago, \$675.

The bids were referred to Committee on Public Improvements of Common Council. Contract will probably be awarded at a meeting to be held October 10.

MONTGOMERY, N. Y.—Our correspondent writes: "We are now building a new iron bridge of two spans of 110 feet each or 220 in all. Bridge will be completed about October 25. The stone-work is very fine. The bridge is being built by the East Berlin Bridge Co., of East Berlin, Conn."

WALTHAM, MASS.—Our correspondent writes: "Our Aldermen have adopted a plan for a stone bridge to cost about \$33,000, but have gone no further. The next step is to authorize its construction and make the appropriation therefor."

CHESTNUT HILL, PA.—The Engineer of Montgomery County has awarded the contract for an iron inter-county bridge over the Wissahickon, near Chestnut Hill, to Dennithorne & Son.

GENEVA, October 12.—Our correspondent writes: "We have built five bridges this summer, and we have two more to build this fall. The Town Board has appropriated \$4,300 for bridge purposes this year."

LEAVENWORTH, KAN.—A movement is on foot here for a new bridge over the Mississippi River. The company has obtained a charter and had plans prepared. Immediate attention is necessary.

DETROIT, MICH.—City Council has voted to award the contract for the Belle Isle bridge to the Milwaukee Bridge and Iron Company, at \$295,000, with the proviso that the city may select the \$305,000 plan.

ELIZABETH, PA.—The Elizabeth Bridge Company organized October 6 by the election of Captain W. W. O'Neil, President; Dr. P. T. B. Shaffer, Secretary. The capital stock will be \$100,000.

CHICAGO.—Bridge construction at three points: For the Dearborn Street substructure Fitzsimons & Carroll will receive \$30,000 from the North Chicago Street Railroad Co., who will themselves remove to this point the present superstructure of Wells Street bridge. For the new Wells Street bridge Fitzsimons & Carroll do the substructure for \$59,000 and the superstructure for \$86,750 (a 4-track bridge). For the Eighteenth Street bridge Joseph Downey does the substructure for the Western Indiana Road on private contract and the Keystone Bridge Co. the superstructure for \$58,000.

BRIDGES.—We note the following: At Northampton, Mass., a bridge to carry South Street over the New Haven and Northampton Railroad. The cost will be about \$20,000.

A company has been formed to bridge the Hudson River at Mechanicsville, N. Y., with a capital stock of \$120,000. George B. Perry is interested.

A bridge will be built over the Northern Central Railway, near Towson, Md., at a cost of \$8,000.

A scheme is on foot for bridging the Oconee River at Dublin, Geo.

At Leavenworth, Kan., a highway bridge, to cost \$500,000.

TAMPA, FLA., will probably have an iron bridge.

MACON, GEO.—Proposals will be received, until November 4, for the erection of a wooden bridge. For further particulars address W. G. Smith, Macon, Geo.

JACKSONVILLE, FLA.—See our Proposals for reference to a bridge over Hogan's Creek.

LEWISVILLE, O.—Address the County Commissioners in regard to a bridge to be built here.

CHICAGO, ILL.—The M. Lassic Bridge and Iron Works has been incorporated; capital stock, \$250,000. Messrs. Moritz Lassic, William G. Schniglaui, and Charles H. Hawkins, incorporators.

WACO, TEX.—Proposals will be received, until November 14, by the Commissioners' Court of Waco, Tex., for the erection of an iron bridge across the Brazos River. The bridge will be 560 feet long, 42 feet high, and 20 feet roadway, tubular iron piers, centre tubes not less than six feet, and end tubes not less than five feet in diameter; the centre span to be 240 feet, and the end spans 160 feet each. The bridge is to have a capacity of not less than 100 pounds to the square foot. For further particulars address the County Commissioners.

TRENTON, N. J., is to have a bridge. Address Commissioners.

RED CLOUD, NEB.—A bridge costing \$13,000 will be built by the County Commissioners.

PORTLAND, ORE.—The Columbia River Bridge Co. has been incorporated; capital stock, \$500,000. The incorporators are H. S. Rowe, M. C. George, R. L. Dunham, and others.

BRIDGE COMPANY.—Incorporated a few days since was the Louisville and Jeffersonville Bridge Company, of Louisville, Ky. Directors: Dennis Long, John F. Read, E. Fuller, and others.

STREET WORK AND PAVING.

RUTHERFORDTON, N. C., will make street improvements; money appropriated.

MOBILE, ALA.—City Council is taking steps to have a large amount of granite street paving done.

WASHINGTON, D. C.—The District Commissioners place in the estimate \$800,000 for street improvements to be made the coming year.

MILWAUKEE, WIS.—Contracts have been let for street work as follows:

John O'Neil, curbing Holton Street, 13 cents per lineal foot.

John Dobberson, grading Twenty-third Street, from Fond du Lac Avenue to Center Street, 15 cents per cubic yard.

Ed. Becker, paving gutters, 67 cents per square yard.

J. H. Kearner, curbing Twentieth Street, 50 cents per lineal foot. Resetting old curb ing, 13 cents per lineal foot.

TORONTO, ONT.—A report has passed the Committee of the Whole of City Council, providing for improvements on the Ravine Park Drives, at a cost of \$225,000.

SARATOGA, N. Y.—Village Engineer Cramer has presented to the Village Board an estimate of the cost of improving East Avenue, placing it at \$23,000.

DETROIT, MICH.—City Council has directed the Board of Public Works to proceed with the improvements of Linden Park.

LITTLE ROCK, ARK.—See our Proposals for reference to brick and concrete sidewalks.

ALTOONA, PA.—The Highway Committee is advertising for bids for macadamizing Green Avenue.

CINCINNATI, O.—C. H. Crane is the contractor for the improvement of Madisonville Pike Road.

MONTREAL, CAN.—About \$4,000 is appropriated for asphalt pavement, to be laid on St. James Street and Place D'Armes, and a contract has been awarded to William McDonald for a sewer in Conde Street, at \$7.75 per lineal yard.

BROOKLYN, DE.—DeKalb Avenue will be paved with granite blocks. Proposals will be received by the Commissioner of City Works until October 19; two sureties, \$8,000 each.

PITTSBURG, PA.—Carson Street, Sycamore Street, Bryant Street, Shiloh Street will be improved. Address E. M. Bigelow, City Engineer.

BOSTON.—It is ordered that Dillon Street be laid out, also Maynard Street. Address J. H. Jenkins, Clerk of Street Commissioners.

LOWELL, MASS.—Council has appropriated \$10,000 for street work.

NEW YORK CITY.—Engineer Greene submitted plans October 13 to the Dock Department for fixing the line of piers from Eighty-sixth Street, where the proposed \$6,000,000 extension street ends, to the Third Avenue Bridge.

RAILROADS, CANALS, ETC.

BLOOMFIELD, N. J.—The Orange Cross-town Railway Company has received permission from the Bloomfield Township Committee to lay tracks in the streets of Bloomfield. It is proposed to connect Bloomfield and Orange.

KNOXVILLE, TENN.—McDonald, Shea, Dunavant & Co. have the contract for building twenty miles of the Powell's Valley Railroad. Work will be begun at once.

PORTLAND, ME.—A committee of the directors of the Rockland, Rockport and Camden Railroad will meet the directors of the Knox and Lincoln to confer with regard to the construction of the railroad from Rockland to Rockport Village in Camden.

CHICAGO, ILL.—The Hoyt Railroad Track Crossing Company, of Chicago, has increased its capital stock from \$500,000 to \$1,000,000.

RENO, NEB.—A street-railroad will be built here. A party is now seeking for a fifty years' franchise from the city.

GALVESTON, TEX.—A. Bonzano, C. E., favors the plans for constructing a breakwater and improving the harbor.

CAMDEN, N. J.—A large engineering work is projected in the removal of Windmill and Smith's Islands, between this city and Philadelphia. We quote the *Philadelphia Express*:

"Last May the Harbor Commissioners requested their Advisory Board to 'examine and report concerning the physical relations of Smith's and Windmill Islands and the shoal thereto to the improvement of the harbor.' Then it was expected that by this time some report would have been made. Now it looks as though fully three months must elapse before the board will make a report to the Harbor Commissioners. Of course the resolution carries with it for consideration the entire removal of the two islands, together with the dredging of extensive shoals North and South. An estimate of the cost reaches \$3,000,000."

MILWAUKEE, WIS.—The Chicago, Milwaukee and St. Paul Railway Company let the contract, October 6, to Shepard & Co., of St. Paul, for building ten miles of road north-west from Goodrich's Mills, a point about four miles north-west of Mather, a station on the Valley Division.

The St. Paul Railroad Company has been asked to pave Hill Street, from Sixth to Eighth Street.

WABASHA, MINN.—At the election October 5 to vote upon the question of issuing \$30,000 bonds for ferry purposes and other local improvements, the proposition was carried by a majority of 160.

NASHUA, N. H.—William H. Ward has been awarded the contract for repairing and strengthening the canal of the Nashua Manufacturing Company.

RAILROAD WORK.—In our Proposal Columns will be found a reference to extensive works to be undertaken by the Rome, Geo., and Columbus Railroad Company.

LEAVENWORTH, KAN.—The Leavenworth, Northern and Southern Railroad has reached this city and will be extended to Denver.

CLEARFIELD, PA.—The preliminary survey, for a railroad connecting the Beech Creek and the Tyrone and Clearfield, has been completed. The elevation to climb from this point is about 1,000 feet and the length of the road will be twenty-eight miles. The enterprise is controlled by Clearfield and Dubois capitalists.

OTTAWA, ONT.—A party of Government engineers are engaged in studying the engineering features of the proposed new route of Sault Ste. Marie Canal. The time for receiving tenders for the work expires in January.

MERIDIAN, MISS.—The contract for grading the Warrior Coal Fields Railroad from Meridian, Miss., to Gainesville, Ala., a distance of 56 miles, has been awarded to Messrs. Dunn Bros., of Birmingham, Ala.

MACKINAC, MICH.—Steps are being taken to build an electric-railway around Mackinac Island.

BIDS OPENED.

PAWNEE CITY, NEB.—The following bids for constructing the water-works at Pawnee City, Neb., were received by the Mayor and Council, October 7, 1887: Charles Schroder, Columbus, Neb., for the whole works (except wells), \$25,125. H. F. Cook & Son, Omaha, Neb., for two tubular wells, \$2,500.

GRAND RAPIDS, MICH.—The following bids for constructing the hospital for contagious diseases were received by the Board of Public Works, September 24, 1887:

Joel Collins, city, \$3,535.
J. D. Boland, city, \$4,200.
John Olson, city, \$4,220.
James Curtis, city, \$5,375. Contract awarded to Joel Collins at \$3,535, October 1, 1887.

LOS ANGELES, CAL.—The following bids for building the Court-House were received by Corbett, Essen & Cuthbertson, Architects, September 20. The specifications referred to two methods of building. Proposition No. 1 will probably be adopted relating to granite basement, superstructure of pressed brick, sandstone and terra cotta trimmings:

F. E. Green, Los Angeles, proposition No. 1, \$387,200; proposition No. 2, \$430,000.
Charles F. Trill, San Francisco, No. 1, \$385,750; No. 2, \$422,275.
David Perry, San Francisco, No. 1, \$380,050; No. 2, \$417,500.
W. E. Stratton, Los Angeles, No. 1, \$380,000; No. 2, \$416,000.
A. F. Mackay, Los Angeles, No. 1, \$381,000; No. 2, \$415,000.
William Hanbon, Los Angeles, No. 1, \$386,000; No. 2, \$421,600.
California Bridge Co., San Francisco, No. 1, \$390,000; No. 2, \$422,000.
William Fletcher, Los Angeles, No. 1, \$385,000; No. 2, \$419,000.
O. E. Brady, San Francisco, No. 1, \$375,000; No. 2, \$410,000.
Contract awarded to O. E. Brady.

CHAUTAUQUA LAKE, N. Y.—The contract for dredging the outlet of Chautauqua Lake has been awarded to Willard Johnson, of Fulton, N. Y., at \$15¢ per cubic yard.

ROCHESTER, N. Y.—The following bids for trenching and laying water pipe in Group No. 128, have been received by the Executive Board:

BIDDERS.	
Andrew E. Hyde.....	\$0.18
William Dyer.....	.20
George Chambers..	.26
N. L. Beyer.....	.20
	4,970 lin. ft. of trenching.
	540 lin. ft. of 10-in. cast-iron pipe.
	1,950 lin. ft. of 8-in. cast-iron pipe.
	2,260 lin. ft. of 6-in. cast-iron pipe.
	185 lin. ft. of 4-in. cast-iron pipe.
	10 additional 10-in. lead joints, over 5.
	10 additional 8-in. lead joints, over 5.
	10 additional 6-in. lead joints, over 5.
	Total.
	\$1,548.15
	1,690.00
	1,950.25
	2,133.00

Awarded to A. E. Hyde.

NEW YORK CITY.—Bids for constructing an engine-house for Company 54 were opened as follows, October 12, by the Fire Department: Mahony Bros., \$15,750; George H. Christie, \$18,245; James H. Brady, \$17,900. All the bidders are New York parties.

NORFOLK, VA.—H. E. Culpepper, of Norfolk, Va., was the lowest bidder at \$2,300 for repairing the St. Helena wharf.

CLEVELAND, O.—The following bids for cast-iron cylinders, for Lake Tunnel, were received by Cleveland Water-Works October 6 (No. of cylinders, 17; total weight, 150 tons):

Bowler & Co., Cleveland, 3½¢ per pound.
Maher & Brayton, Cleveland, 3½¢ per pound.
Cross Bros. & Scheuer, Cleveland, 3½¢ per pound.
Lake Shore Foundry, Cleveland, 4½¢ per pound.
Walker Manufacturing Co., Cleveland, 3½¢ per pound.
Variety Iron Works, Cleveland, 2 a 10¢ per pound.
Cleveland Shipbuilding Co., Cleveland, 2 a 10¢ per pound.
Contract awarded to United Iron Works at 2 a 10¢ per pound.

BROOKLYN.—Bids have been received as follows by the Bridge Trustees:

For two switching locomotives, to the Dickson Manufacturing Co., of Scranton, Pa., at \$5,500 each.
For yellow pine flooring for Washington Street extension to Nassau street, 4,197 feet, B. M., to be planed; 23,704 feet, B. M., not planed; South Brooklyn Saw-Mill Company, \$2,888.57; Cooney & Eckstein, \$3,041.41; Eppenger & Russell, \$3,076.81; Beers & Resig, \$3,306.40. Contract awarded to South Brooklyn Co.

Sheet and iron work for Brooklyn approach: New Jersey Steel and Iron Company bid 57-100¢ per pound erected.

Keystone Bridge Company bid 7½¢ per pound erected.

Pincoyd Iron Company declined to bid.
Passaic Rolling Company declined to bid.
Phoenix Bridge Company not heard from.
The above firms had been specially invited to bid. Contract to the New Jersey Steel and Iron Company.

MILWAUKEE.—The Board of Public Works opened bids October 7 for building section No. 6, of the Menomonee sewer, on Muskego Avenue to the south line of North Canal Street. The contract was let to C. H. Sullivan, who will receive \$12.31 per foot, and \$15.28 per foot where an extra foundation is necessary. Bids as below:

William Forrestal, per foot, Plan A, \$12.75; Plan B, \$17.
Charles Brand, \$14.90, \$18.75.
J. C. F. Brand, \$14.75, \$19.85.
James Markey, \$12.45, \$19.25.
John S. O'Neill, \$13.85, \$17.
C. H. Sullivan, \$12.31, \$15.28.
John O'Neill informal.

ALLEGHENY, PA.—The contract for constructing an iron water-tank on Linden Avenue has been awarded to D. W. C. Carroll, at \$2,283.50.

CHICAGO.—A contract for 2,300 tons of cast-iron water-pipe is let to the Lake Shore Foundry of Cleveland, for \$71,185, at their uniform bid of \$30.95 per ton for 6-inch, 8-inch, 12-inch, and 16-inch pipe. The other bids were: Philadelphia Pipe Works Co., of New Philadelphia, O., \$31.50; James B. Clow & Son, Chicago, \$35.10 for 6-inch; \$37.70 for 8-inch; \$34.25 for 12-inch; Buffalo Cast-Iron Pipe Co., of Buffalo, \$32.25 for 6-inch and \$33.25 for the rest; McNeal Pipe & Foundry Co., Burlington, N. J., \$34.37 for 6-inch, \$33.93 for 8-inch; \$33.04 for 12-inch, and \$31.59 for 16-inch; Shickle, Harrison & Howard Iron Co., St. Louis, \$36.75 for 6-inch; \$34.25 for 8-inch; \$33.75 for 12-inch, and \$33.50 for 16-inch; Rogers, Brown & Co., Cincinnati and Chicago, \$31.50, uniform bid; R. D. Wood & Co., Philadelphia, \$32.74, uniform bid; D. Lang & Co., \$34 uniform bid; Cincinnati & Newport Iron & Pipe Co., \$32.48, uniform bid; Gloucester Iron Works, Gloucester, Mass., \$31.75 for 12 and 16 inch; National Foundry & Pipe Works, Scottsdale, Ind. and Pittsburg, \$35 for 6 and 8 inch and \$35.50 for 12-inch.

BALTIMORE, MD.—Messrs. Crook, Horner & Co., of this city, have been awarded the contract for the plumbing of court-house and post-office at Oxford, Miss. Contract price, \$2,140.

CUMBERLAND, MD.—The Kelly & Jones Co., of Pittsburg, Pa., and New York, have been awarded the contract for the heating apparatus for the Insane Asylum at this place at \$4,417. Messrs. Landwehr & Glick, of this city, have the contract for boiler and pump-house.

NEW YORK CITY.—Bids were opened at the Department of Docks on October 13 for preparing and building a wooden platform for pier at Blackwell's Island, East River, and for removing a part of pier. The work was divided by the specification in three classes—viz.: (1) Crib dredging, about 540 cubic yards; (2) Removal of old work and repairs to existing platform, about 1,407 feet B. M. yellow pine timber, measured in the work; (3) New platform, about 8,607 feet B. M. yellow pine timber, and labor.

The following were the bidders:
Moses Engle, first class, \$1.75 per cubic yard; second class, \$2.88; third class, \$4.68; Fearon & Jenks, \$1.75, \$500, \$5,000; John W. Flaherty, \$1.50, \$925, \$3,750; John D. Walsh, \$1.50, \$483, \$5,342; D. W. Gillies, \$1.50, \$375, \$4,178.

GOVERNMENT WORK.

ABSTRACT of bids for dredging in Raritan River, N. J., opened at the United States Engineer Office, Army Building, New York City, at 12 o'clock M. on September 22, under circular dated September 12:

BIDDERS.		Price per cubic yard measured in row.
W. H. Beard, 302 Hamilton Avenue, 302 Brooklyn, N. Y.,	\$4.50	For 700 feet rocky section of channel.
Eljah Brand, 24 New York,	4.50	
Harford Dredging Co., 40 South Street, New York,	4.50	
M. K. Pidgeon, New York,	4.50	
	4.50	For remaining 4,100 feet of channel.

* For all material that can be dredged without blasting.
† Rock-work not included.

GOVERNOR'S ISLAND, N. Y.—The following bids for furnishing and laying water-pipe between Governor's Island and Brooklyn, N. Y., were received by Captain J. H. Lord, Assistant Quartermaster, October 7:
John F. Ward, Jersey City, Hudson Co., N. J., \$12,400; accepted.

SYNOPSIS of bids for ventilating and steam-heating at Concord, N. H., opened by the Supervising Architect October 10: L. E. Milles, \$6,170, Walworth radiator; Bartlett, Hayward & Co., \$7,125, 1' vertical, own.

Same for Leavenworth, Kan.—Bartlett, Hayward & Co., \$14,800, 1' vertical, own radiator, Sturtevant fan; James Foley, \$9,975.

Same for Hannibal, Mo.—Bartlett, Hayward & Co., \$5,180, 1' vertical, own radiator; Herbert L. Rose, \$4,067.65, Haxton's; L. Pope & Co., \$5,790, Crane's, Walworth's, and Gold's.

OMAHA, NEB.—The following bids for superstructure of new City Hall building, Omaha, Neb., were received and opened by Board of Public Works, Omaha, Neb., October 7:

Sholes & Co., Omaha, Neb., \$234,490; Brennan Bros., Omaha, Neb., \$259,640; Rice & Bassett, Omaha, Neb., \$261,473.82; James Griffith, Omaha, Neb., \$285,000; Cunningham & Ryan, Omaha, Neb., \$293,675; James Fox & Co., Omaha, Neb., \$360,640.

Contract will not be awarded until Supervising Architect Myers arrives from the East, which will be some time this week.

WASHINGTON, D. C., Navy Department.—There was but one bid for the dredging at Coaster's Harbor Island, R. I., that of Mr. C. M. Anthony, of Fall River, Mass., whose offer was forty cents per cubic yard; but being quite informal, not on required form, nor accompanied by guaranty required by law, it was not considered.

SYNOPSIS of bids for materials, tools, and labor for plumbing for Court-House and Post-Office, Waco, Tex., opened by the Supervising Architect October 10 (first opened September 20 and rejected):

May & Wainwright, entire work, \$4,518.14; base ment only, \$2,032.04; basement and second story, \$3,744.20; basement and third story, \$3,705.80.
Crook, Horner & Co., entire work, \$5,370.05; base ment only, \$3,866.21; basement and second story, \$4,618.14; basement and third story, \$4,618.14.
P. Nacey, entire work, \$4,739; basement only, \$1,511.31; basement and second story, \$2,732.67; basement and third story, \$2,688.66.
Marion & Co., entire work, \$3,911.60; basement only, \$2,608.05; basement and second story, \$3,260.10; basement and third story, \$3,260.10.

NORFOLK, VA.—The contract for repairing the roofs of the Naval Hospital has been awarded to Mr. John Massingham of this city. The following were the bids: W. H. Barnard & Co., Norfolk, \$750; J. V. Kierman, Norfolk, \$590; J. E. Wright, Norfolk, \$560; B. A. Richardson, Norfolk, \$470; John Massingham, Portsmouth, \$380.

DAVID'S ISLAND, N. Y. H., October 7.—The following bids for brick sidewalk were received by Captain George H. Cook, A. Q. M., October 6:
Fallon & Sheehan, New Rochelle, N. Y., 90¢ per lineal foot; Richard Calrow, Brooklyn, N. Y., \$1.13 per lineal foot; Murphy & Gillespie, New York, \$1.105 for the entire work. The contract was awarded to Fallon & Sheehan, of New Rochelle, at 90¢ per foot for 1,055 feet.

WASHINGTON, D. C.—The new set of bids on plumbing for the Waco, Tex., public building were opened by the Supervising Architect, October 10, as follows: May & Wainwright, Galveston, whole job, \$4,518; in basement, \$2,032; basement and second story, \$3,744; basement and third story, \$3,705; time, 100 days.

Crook, Horner & Co., Baltimore, whole job, \$5,370; in basement, \$3,866; basement and second story, \$4,618; basement and third story, \$4,618; time, ninety days.

P. Nacey, Chicago, whole job, \$4,939; in basement, \$1,512; basement and second story, \$2,732; basement and third story, \$2,688; time, sixty days.

Manion & Co., New Orleans, whole job, \$3,911; in basement, \$2,608; basement and second story, \$3,260; basement and third story, \$3,260; time, sixty days.

ABSTRACT of bids for dredging in South River, N. J., opened at the U. S. Engineer Office, Army Building, New York City, at 12 o'clock m., on September 22, under circular dated September 12:

P. Sanford Ross, 113 Hudson Street, Jersey City, N. J., 2 1/2 cents per cubic yard measured in scow.

M. K. Pidgeon, 60 South Street, New York City, 32 cents.

W. H. Beard, 302 Hamilton Avenue, Brooklyn, N. Y., 35 cents.

James M. Spint, 330 Third Street, Jersey City, N. J., 34 cents.

Hartford Dredging Company, Hartford, Conn., 29 cents.

Richard M. Payn, 61 Quay Street, Albany, N. Y., 29 1/2 cents.

CHelsea, MASS.—The only bid opened by the Supervising Architect September 30 for repairs of heating and ventilating apparatus of Marine Hospital at Chelsea, Mass., was that of the Walworth Manufacturing Company, of Boston, \$18,797.

PROPOSALS.

(Continued from page 544.)

NEW FLOORS, etc., at Bellevue Hospital.—Bids or estimates will be received at the office of the Department of Public Charities and Correction, No. 66 Third Avenue, in the city of New York, until 9:30 o'clock a. m. of Tuesday, October 18.

COUNTY JAIL.—Proposals will be received by the County Commissioners of Duval County, Fla., until December 5, for the building of an addition to the County Jail in plan, 44 feet by 58 feet, to contain 42 cells. Plans can be seen and specifications procured at the office of R. N. Ellis, County Engineer, Bostwick's Block, Jacksonville, Fla. Separate bids will be received for the iron-work. Endorse "Bids for County Jail," and direct to Captain W. E. Buckman, County Clerk, Jacksonville.

STEAM-HEATING apparatus for the Seventh Precinct, Brooklyn.—Proposals will be received until the 18th day of October for furnishing steam-heating apparatus for the Seventh Precinct Police Station-House, corner of Greenpoint Avenue and Manhattan Avenue. Thomas Carroll, Commissioner of the Department of Police.

ROAD-WORK.—Proposals will be received by the clerk of the village of Mt. Airy, O., until November 5, for the improvement of the Cary Road, by grading, macadamizing and graveling the same, and constructing drains, culverts and bridges, in accordance with plans and specifications on file with A. A. Brasher, Engineer. E. George Jacobs, Corporation Clerk, Mt. Airy, O.

RETAINING WALL.—Proposals will be received until October 18, to furnish the materials and do the work on a retaining wall on the Falls Road, between Maryland and North Avenues, Baltimore, Md. A. E. Smyrk, City Commissioner, Baltimore, Md.

BRICK SIDEWALKS.—The Commissioners of Improvement District No. 4, want proposals until October 17, for laying brick sidewalks in the district. Address R. A. Edgerton, Room 16, Bowman Block, Little Rock, Ark.

LIGHTHOUSE-WORK.—Proposals will be received until the 22d day of October for furnishing the materials and labor for the construction of the metal-work for the Castle Hill Lighthouse, Narragansett Bay, Rhode Island. Major D. P. Heap, U. S. Engineers, Tompkinsville, S. I.

BRIDGE.—Proposals for a bridge over Hogan's Creek at the crossing of the same by Duval Street Bridge, Jacksonville, Fla., to be thirty feet wide, with approaches twelve feet wide on each side of bridge; also for building a roadway 368 feet, and twenty feet on East Jacksonville side across marsh. Total length of bridge including roadway about 430 feet. W. B. Watson, Room 6, Ely Block, Jacksonville, Fla.

LEVEE-WORK.—Proposals will be received, until October 25, for levee work on the White River front to the approximate amount of 400,000 cubic yards. Smith S. Leach, Captain of Engineers, Memphis, Tenn.

BUILDING.—Proposals will be received, until November 4, for building Court-House. Address John F. Sharp, Clerk Board of Supervisors, Louisville, Miss.

PROPOSALS will be received by the Commissioners of Montgomery County, Pa., at their office, in Norristown, up to 17th day of October, for the masonry and repairing of two bridges, one over Five Mile Run, the other over Stony Creek on Germantown pike in the township of Norristown. James Burnett, Hiram Burdian, Thomas McCully, Commissioners.

PUMPING ENGINES.—Proposals will be received at the City Engineer's office, Minneapolis, Minn., until November 17, for the construction, delivery, and erection of two horizontal compound condensing pumping engines, with a daily capacity of fifteen million gallons each; also for building and erecting a pumping station near Shingle Creek; also for furnishing about 12,000 lineal feet of 36-inch cast-iron water-pipe. Specifications for pumping-engines and cast-iron pipe and plans and specifications for the building, can be seen at this office. Parties bidding can state a price for any part or the whole of the work, but a separate proposal, properly endorsed, must be submitted for each of the three (3) classes of work advertised for. The right to reject any or all proposals is reserved. Andrew Rinker, City Engineer.

NEW WELL.—Proposals will be received until October 27, for furnishing materials and constructing a well and appurtenances. The well consists, in general, of a caisson about 35 feet high and 25 feet in diameter, with iron shoe, dome, 24-inch suction-pipe and fittings, etc. The foot of the caisson is to be sunk about 35 feet below ground line. Chauncey Strong, City Clerk, Kalamazoo, Mich.

PROPOSALS.

IMPROVING BUILDING.—Superintendent's Lodge at Natchez, Miss., National Cemetery. Until October 20. Address Major E. B. Kirk, U. S. A., Gate City Bank Building, Atlanta, Geo.

BRIDGES.—Proposals will be received until October 15, for the construction of three bridges over the Natchez and Yakima Rivers. Address W. F. Prosser, North Yakima, Wash. T.

BRIDGE.—Proposals are invited for the erection of a 150-foot span iron bridge. For further particulars address William P. Kelly, San Angelo, Tex.

WATER-WORKS.—Proposals will be received for the construction of water-works in the town of St. Andrews, N. B. The estimated quantity of pipe is 4 miles, with hydrants, etc. Full particulars on application to T. McGrath.

THE Board of Supervisors of Winston County, Miss., will receive bids on November 7 for the building of a new court-house at Louisville, Miss. Plans and specifications are on file in the Chancery Clerk's office. John F. Sharp, Clerk Board of Supervisors, Louisville, Miss.

PILE FOUNDATION.—Proposals will be received until October 19, for constructing about 3,500 lineal feet of pile and timber foundation for Section V. of Boulevard sewer, New Haven, Conn. Albert B. Hill, City Engineer. City Engineer's Office, 17 City Hall, New Haven, Conn.

STEAM-HEATING apparatus for the Sixth Precinct.—Proposals will be received until Tuesday, the 18th day of October, for furnishing steam-heating apparatus for the Sixth Precinct Police Station House, corner of Bushwick Avenue and Stagg Street, Brooklyn, E. D. Thomas Carroll, Commissioner of the Department of Police and Excise, Brooklyn, N. Y.

BUILDING INTELLIGENCE.

(Continued from page 540.)

BOSTON.—Centre or Burroughs, br apartment; cost, \$12,000; o, Wm Rooney; a, W H Winslow.

508-600 Atlantic av, br stores; cost, \$40,000; o, Nichols, Dupee & Co; a, B F Dwight; b, Sampson, Clark & Co.

96-8 Huntington av, br apartments; cost, \$44,000; o, Thompson & Gibson; a, Fred Pope; b, Gilmore & McGowan.

215-17 Huntington av, br apartment; cost, \$44,000; o, Albion Knowlton; a, Fred Pope; b, Charles A Dodge.

Congress st, br storehouse; cost, \$60,000; o, Boston Wharf Co; a, M D Safford; b, Chas A Dodge.

CHICAGO, ILL.—186-88 Pacific av, br flats; cost, \$10,000; o, Isaac E Adams; a, C. J. Warren; b, Daegling & Faber.

828 W Taylor, br st and flats; cost, \$8,000; o, Jno W Wittene; a, A Besler; b, Voght & Douglar.

738 Washington Bd br flats; cost, \$7,500; o, C H Lowe; a, W A Harlow; b, Edwards & Perry.

395 Oak, flats; cost, \$7,500; o, Mrs Helen S Brown; a, Geo Spohr; b, William Charles.

3416-18 Michigan av, br dwell; cost, \$45,000; o, J L Woodward; a, W W Clay; b, A G Hageman.

293-95 Lincoln av, br st and flats; cost, \$10,000; o, F Kaufman; a, Froman & Jensen; b, Wm Soelker.

196-202 W Adams, br flats; cost, \$20,000; o, Jesse Halladay; a, Jas M Von Osdel & Co; b, Allen & Gindele.

1019-21 W Lake, br st and flats; cost, \$18,000; o, R F Conway; a, A Smith; b, Wm Rudolph.

1200-1300 State, br freight house; cost, \$20,000; o, Atchison, Topeka, and S. F.; a and b, E G Nourse.

39 Hamlin av, br st and flats; cost, \$7,500; o, Jas Fitzsimons; a, Addison & Fiedler; b, F Markoefer.

3001 Wallace, br st and flats; cost, \$8,000; o, Wm Rahm; a, Jno F Doerr; b, Wm Reinert.

84 25th, br flats; cost, \$7,500; o, William Hadden; a, Jno Otter; b, Oscar Anderson.

483-503 Hinman, br factory; cost, \$15,000; o, Maxwell Bros.; a and b, Tobiasson & Co.

2539 Michigan av, br dwell; cost, \$23,000; o, W A Gibbs; a, W L Clay; b, B. G. Robinson.

19-27 Coventry; br factory; cost, \$7,500; o, D W Ryan; a, J H Wagner; b, A Dellosse.

Prairie av and 22d st, br and st barn and office addn; cost, some \$15,000; o, Dr Hale; a, Cobb & Frost.

Superior st, nr Lake, br and st dwell; cost, \$14,000; o, James Walsh; a, same as above.

Fourth av, nr 35th, br and st dwell; cost, \$8,000; o, M Lester Coffeen; a, same as above.

Prairie av below 30th, br and st dwell; cost, \$8,000; o, John McCoy; a, same as above.

BLUE SPRING, FLA.—40-room hotel to be built here at once.

TITUSVILLE, FLA.—Episcopal church; b, L R Decker.

ATLANTA, GEO.—The Silver Spring Park Land Company has bought a large tract near here, and will do much building, etc.

GAINESVILLE, FLA.—Presbyterian church in progress.

LONG BEACH, N J.—100 oyster houses, 30x40 feet each; o, West Jersey Railway Co.; contracts let.

GRAND RAPIDS, MICH.—Permanent Exchange Bld; o, I C Leve; a, Osgood; estimated cost, \$50,000.

WORCESTER, MASS.—Jaques av, br addn to hospital; cost, \$15,000; o, city of W.; a, Barker & Nourse; b, not let.

DETROIT—73 Baker, br store; cost, \$7,000; o, Hugh Gamble; a, W G Malcomson; b, H S Peoples.

915 Jefferson av, br dwell; cost, \$15,000; o, H Russel; a, Scott & Co.; b, J. E. Boomer.

Cass, br dwell; cost, \$7,000; o, G J Vinton; a, same as above; b, Clark, Vinton & Co.

71 Cass, br store; cost, \$10,000; o, T A McGraw; a, P Dedericks; b, A Chapoton, Jr.

1007 Michigan, br store; cost, \$7,000; o, A Grosfield; a, same as above; b, A Dorsch.

648 Sixth, br store; \$7,000; o, J G Gascon; a, A Apel; b, Boyce & Craig.

GRAND RAPIDS, MICH.—Fourth Holland Christian Reformed Church, on La Gran st, stone and br; cost, \$15,000; contracts let.

PHILADELPHIA.—Howard, ab Lehigh av, office bldg; b, Einwechter & Hyzer.

Church, bet Wood and Hamilton, 4-story storehouse; b, S S Keely.

Cumberland and Mills, 4-story br mill, 54x150 feet; o, B Hamil & Co.

And 187 other 2 and 3 story buildings.

MINNEAPOLIS, MINN.—S w cor 1st av and 4th, foundation bank bldg; cost, \$11,500; o, National Bank of Commerce; a, H W Jones.

S e Minneapolis, grain elevator; cost, \$151,100; o, St Anthony Elevator Co.

6th, bet 7th and 8th av S, br school bldg; cost, \$40,000; o, Board of Education; a, Long & Kees; b, let by separate contracts.

Cor Knox av and 10th av N, fr dwell; cost, \$13,000; o, C W Sexton.

615-621 9th S, br tenement; cost, \$36,000; o, a, and b, Haglin & Morse.

River Road N, grain elevator; o, Minneapolis & Pacific R R Co.

Cor 2d and 1st av S, foundation br store; cost, \$11,275; o, George A Brackett and others; a, Orff Bros; b, piece contract.

E 20th, bet 3d and 3 1/2 avs S, br dwell; cost, \$12,000; o, A J Finnegan.

Sandy Lake, E D, br RR bldgs; cost, \$125,000; o, Minneapolis, Sault Ste. Marie and Atlantic RR Co.

W Tyndale av, nr 17th, br barn; cost, \$10,000; o, H T Wells; o, W D Kimball; b, Seymour.

402 W 20th, fr dwell; cost, \$10,000; o, C J Buell.

FREDONIA, KAN.—A \$10,000 school-house will be built here.

KANSAS CITY, MO.—13th, bet Locust and Cherry, 2 story br dwell; cost, \$9,000; o, George Sass.

Frost and Beacon Hill, 2 1/2-story br dwell; cost, \$25,000; o, K S Barton; a, Mathews & Sanders.

2,115-2,117 Lexington av, 2 1/2-story br dwell; cost, \$7,000; o, Emma B Fuller.

18th, cor Grove, 3 story br store; cost, \$10,000; o, Max Isaacs.

N e cor Wyandotte and 12th, 5 story br club house; cost, \$110,000; o, K C Club.

Hampton, add 2 story br dwell; cost, \$7,000; o, C E Cooper.

125 bldgs costing less than \$7,000.

PROVIDENCE, R. I.—Nothing new over \$7,000; 12 permits for buildings costing less than \$7,000.

TRENTON, N. J.—Union Engine Co.'s house; cost, \$5,285; b, Furman & Kite.

WHEELING, W. VA.—Projected, a hotel on Market Street; o, Henry Schmulbach.

HARRISBURG, PA.—Nothing over \$7,000 in value this week.

NEW ORLEANS, LA.—Crescent City Brewery bldg; E J Ames, President.

ARKANSAS CITY, KAN.—The contract for the building of the Fifth Avenue Opera House at Arkansas City has been let; cost, \$60,000.

MIDDLETOWN, N. Y.—St Joseph's Catholic school house; cost, \$15,000; contracts not yet let.

TRINIDAD, COL.—A town hall will be built here.

WASHINGTON.—Cor N J av and B st, 5-story br bldg; cost, \$97,000; o, M G Lane; a, R Stead; b, D W Gottwall.

628-30 K, 2 3-story br bldgs; cost, \$11,500; o, J T Doran; a, R Downing.

1311-39, alley in square 235, 15 2-story br bldgs; cost, \$10,000; o, W W McCullough.

116-18 Md av, 2 2-story br bldgs; cost, \$8,000; o, G B Whitney; a, J L Parsons.

115-17 B, 2 2-story br bldgs; cost, \$6,000; o, G B Whitney; a, J L Parsons.

N, bet 12th and 13th; 2-story br bldg; cost, \$20,000; o, Washington Gas Co; a, J L Parsons.

12th and M, n w, 3-story br bldg; cost, \$7,500; o, E J Hill; a, T R Watson.

F, bet 9th and 10th, 8-story br bldg; cost, \$110,000; o, A T Britton; a, J G Hill; b, F N Carver.

Cor 10th and N C av, 2 2-story br bldgs; cost, \$7,000; o, J M Stockett; a, T F Schnieder; b, P Hepburn.

1324 Mass av, 3-story br bldg; cost, \$12,500; o, G Francis; a, Glenn Brown.

150 permits less than \$7,000 in three weeks.

SOUTH BEND, IND.—Rough stone barn, cost, \$15,000; o, Clem Studebaker; a, Cobb & Frost, of Chicago.

2 br and stone store bldgs; cost, \$12,000; o, Clem Studebaker; a, Cobb & Frost.

MEMPHIS, TENN.—Fr residence; cost, some \$15,000; o, E M. Cooper; a, Cobb & Frost.

KENOSHA, WIS.—Depot; o, Chicago and N W R R Co; a, Cobb & Frost. Chicago, who are also building several smaller depots on the same railroad.

BRIDGEPORT, O.—Presbyterian church; plans at office of A J Baggs, Building Committee; contracts let to-day.

CURTIS, MICH., will have a new hotel built; address the city clerk.

LAKE ODESSA, MICH.—New elevator bldg; o, M Gruber.

BANCROFT, MICH.—Factory for Huntington's Car Coupler Co.

DAYTON, O.—3-story br brewery; cost, \$20,000; o, N Thomas & Co; a, Peters & Burns; separate contracts.

BALTIMORE, MD.—Holiday, nr Centre, 3-story br bldg; o, Hy McShane.

Warren, nr Carway, 3-story br bldg; o, E Warfield.

Caroline, nr Pratt, 3-story br bldg; o, Wm Shea.

Etting, nr Prestman, 6 3-story br bldgs; o, Fred Stamp.

Cor Eden and Hoffman, 3-story br bldg; o, Mary E Hooper.

MILWAUKEE.—6th av, near Lapham, br store; cost, \$8,500; o, J Schlitz Brewing Co.

Broadway, near Juneau av, br veneered dwell; cost, \$8,000; o, John Lipps.

3d st, br malt kiln; cost, \$10,000; o, Jos Schlitz Brewing Co.

Cedar st, near 30th, fr dwell; cost, \$7,000; o, P Meehan; a, C Kirchoff, Jr.

27 new buildings under \$7,000.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.

NUMBER 21.

PUBLISHED EVERY SATURDAY.

NEW YORK, OCTOBER 22, 1887.

LONDON, NOVEMBER 5, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
98 & 92 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 20, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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STATE ENGINEER AND SECRETARY OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

MR. JOHN BOGART, the well-known Secretary of the American Society of Civil Engineers, has finally consented to accept the nomination for State Engineer unanimously tendered him by the Democratic State Convention. We believe he will be elected, and that the State will secure the services of a good engineer and a gentleman.

The gratification, however, which all his friends and supporters will feel at such a result must, in the case of his fellow members of the society, be largely tempered with regret at the thought that the society will, in all probability, lose his services as secretary, since it must be apparent that its interests will require more time than the probable engagements of Mr. Bogart would permit him to give. He has served the society well during many years, and has in that time seen it grow in influence and prosperity, which must be a source of great satisfaction to him, and we hope he will long continue to be a member of its board of direction.

The present movement looking to a change in the by-laws of the society with a view of increasing its popularity with the members of the profession, while at the same time relaxing nothing from its high standard of qualifications for membership, indicates a proper appreciation of the field the society should occupy. Much will depend in the future, as it has in the past, on the character and capacity of its most active executive officer—namely, its secretary. With him must originate many things that will increase the usefulness of the society to its members and thereby add to its influence and popularity.

The time has now come when it is necessary that the man who holds this office should have no other professional engagements. The salary should be increased, so that this may be practicable and that the proper man may be secured—one whose whole time and efforts can be devoted to promoting the best interests of the society.

To indicate our idea of the kind of man who could meet the requirements of the case we would name Captain Edgar B. Van Winkle, a member of the society, and now the efficient Recorder of the New York Commandery of the Military Order of the Loyal Legion. In thus naming him we owe it to him to say that we do it without his knowledge or consent, and we have no idea whether he would accept the office even if it were offered to him. Yet in our opinion he typifies the kind of man the American Society of Civil Engineers should have for its secretary, should Mr. Bogart be elected State Engineer.

EDUCATION IN ENGINEERING.

AN address by Professor Osborne Reynolds before the section of Mechanical Science of the British Association deals with this subject. One of the thoughts he expresses is "the smallness in number of recorded attempts to decide the broader questions in engineering by systematic experiments," notwithstanding the great results which, in the long run, have followed as an effect. This becomes a plea for the establishment of engineering laboratories as an adjunct of all institutions for teaching of practical science. These laboratories and the educational workshops that have been introduced undoubtedly serve an

admirable purpose in giving students a trained eye, a mechanical touch, and sound ideas respecting materials.

We cannot but feel, however, that the great mass of engineers, from the nature of the case, become practitioners, rather than original investigators. Time will not allow them to make exhaustive examinations in any direction, and even if it did, the funds that are requisite are not forthcoming. The man who is to make a scientific investigation needs to have nothing else to interfere with his thoughts. If he would see deeper than others have, he must become so imbued with the subject that he cannot think of other things if he would. When he is in this frame, no phenomena, however small, escape him, and the whole mass of observations goes through a process of mental digestion and sifting, from which the truth comes forth as a new creation for the use of the man of action.

We believe in the manual education of engineers as a corrective of the purely theoretical. We believe, also, that there is room for men of intellect and leisure to go on increasing our stock of knowledge from which the practicing engineers must draw.

THE SPECIFIC GERM OF TYPHOID FEVER.

THAT typhoid fever is due to a particular kind of bacillus has for several years been considered extremely probable by those who have investigated the subject. Mr. Desmond Fitz Gerald, a well-known engineer of Boston, recently wrote a letter to the *Boston Advertiser*, from Paris, in which he gives an account of recent investigations on this subject made by Drs. Chantemesse and Widal, and declares, as the result of his observations, that he now has no doubt that the disease may be communicated by means of bacilli carried in drinking-water. The water-supply of Paris comes from several sources.

"Of these the Vanne is undoubtedly an excellent water, and there is no danger to be apprehended from its use. Unfortunately, almost every year the water from this source fails to be sufficient in quantity, and then the water from the Seine and other polluted sources is turned into certain quarters of the city. It has been noticed for several years that when this takes place the number of typhoid cases immediately increases. Drs. Chantemesse and Widal have been able to show that these polluted waters contain the bacilli of typhoid fever.

"In 1882 there were 3,352 deaths in Paris from typhoid. In the first six months of the year there were 965 deaths. In August the deaths from this cause reached 325, in September 275, and in October the number suddenly increased to 860. The number diminished again rapidly in November and December. During this time much of the waters of the Seine, the Ourcq, and the Marne were distributed for drinking purposes, and in the 11th and 12th arrondissements there was scarcely any other water in August, September, and October excepting that of the Seine. Among the firemen of the city it was found that there were very few deaths among those who drank the Vanne, while there were many cases among those who drank from the sewage-charged waters. Dr. Chantemesse told me that he had been able to propagate colonies of the typhoid bacilli in the water of the Seine for more than three months, and that they lost nothing of their activity at the end of that time.

"In nineteen cases out of twenty of persons suffering from typhoid fever Dr. Chantemesse told me he had never

failed to find the typhoid bacilli in certain portions of the body. The moment convalescence begins the bacillus disappears.

"In the middle of the summer of 1886 a family composed of seven persons inhabited a house in the Rue des Rasselins, Menilmontant. Five of them were attacked with typhoid fever and sent to the hospital. They had been drinking the water from a public fountain in their neighborhood, in which Dr. Chantemesse found the living bacillus of the typhoid. In an epidemic at Pierrefonds the water of the wells was found to contain the same bacillus. At Clermont-Ferrand, a city in the Auvergne Mountains and capital of the Puy de Dome, there was an epidemic a short time since of typhoid. The connection between the cases in that city and the water-supply was traced by Dr. Chantemesse. The following experiment was made to show the persistence of the typhoid bacillus: A flask was filled with water, and in the bottom of the flask a little earth was introduced. Some colonies of the bacillus were cultivated in the water. At the end of two months the water, having failed to show the presence of specific germs or spores, was decanted gently, and ordinary water put into the flask on top of the sand and earth remaining in the flask. The next day this water was found charged with the typhoid bacillus. This experiment shows the importance of a most thorough cleaning

cific germ of typhoid fever which flourishes in water polluted by sewage. It is probable that this germ soon loses its vitality in comparatively pure water, especially if this is well aerated. It is also easy to understand that the absence of typhoid fever in a community is no proof that its water-supply is not polluted; it may simply indicate that the specific germ has not yet been introduced, although the conditions are favorable for its development, and it is to be feared that this is the case in many of our American towns and villages.

BUILDING INSPECTION THAT DOES NOT INSPECT.

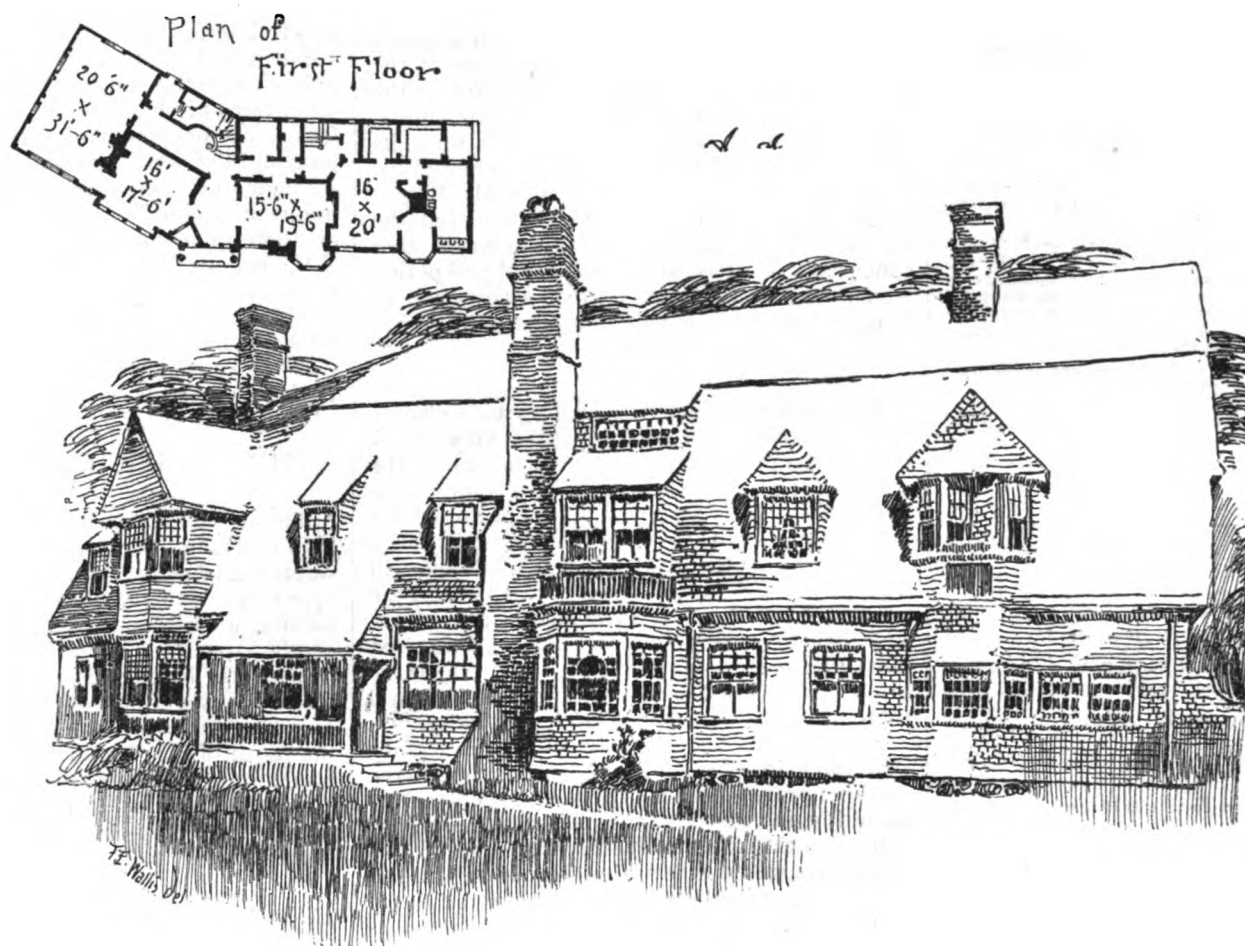
INSPECTION that does not inspect, or, if it does, fails to report, alone made possible the shocking disaster in the Harlem school building elsewhere referred to, and it is well that the delinquent inspector should be promptly and properly punished, but the fault after all lies as much

conscience and convenience and usually far exceeding anything contemplated by the authors of the unreasonable requirement.

If the Fire Commissioners have the authority and the means to employ a sufficient number of additional inspectors they should do so at once, and if not they should immediately make their wants known in the proper quarter. They cannot otherwise escape a very grave responsibility, and as it is they may congratulate themselves that matters are no worse, and that the accident was not delayed until the building was filled with children.

THE RETORT-HOUSE ROOF.

THERE is little for modern builders to learn from the fall of the retort-house roof, described and illustrated on another page, for nobody would think of using flat iron for rafters nowadays; but we believe there are not a few of such roofs still in use, and it behooves the users



RESIDENCE AT WORCESTER, MASS.—W. R. EMERSON, ARCHITECT.

of the bottom and sides of reservoirs, aqueducts, etc., which have been exposed to the bacillus, and it also applies to the interior surfaces of pipes.

"The village of Monts is divided into two portions, one on a hill several hundred feet above the other. On the higher portion, in 1878, two cases of typhoid fever appeared among some children. Their linen was washed in the water from which the lower portion of the village took its supply. In a short time an epidemic broke out in this portion of the village, and it was arrested after the water-supply was abandoned. This was rather a striking case, for out of thirty-three inhabitants of the lower portion fourteen were attacked, and those only escaped who did not use the public water. Other cases might be cited where the presence of an epidemic of typhoid fever has been found to coincide with the presence of the specific germ in the drinking-water. The principal value of the recent progress made in the study of the subject consists in the complete identification of a specific form of bacteria, which has its own individual peculiarities, and which is found always in the body of the typhoid patient. I have seen in the laboratories at Paris all the various stages of growth of this typhoid bacillus, from the soft, round and almost colorless spores, to the active young creature, squirming around by the thousand; in fact, I was offered a small colony of them if I wished to transport them to Boston for cultivation."

It will be seen that Mr. Fitz Geraid gives good reasons for his belief in the existence of a spe-

with the system as with the individual. The statement in the report of the Superintendent of the Bureau of Inspection of Buildings to the effect that each inspector is required to examine and report on an average of over 110 buildings and alterations each day, affords a text from which a very wholesome sermon could be preached to the Board of Fire Commissioners of this city. It is manifestly impossible for the inspectors to comply with this requirement, and practically they are not expected to do so, but any regulation which has to be continually ignored and which requires a pretence of doing what everybody knows cannot be done is utterly demoralizing.

Duty and ability are always commensurate, and requirement should be also. When all is required of a man that he can fairly do and he is held strictly accountable for its full performance, the effect is most salutary, but to require more than that means either tyranny or connivance at neglect and disobedience; and when neglect and disobedience are once tolerated their amount is on a sliding scale, measured only by the individual

to see to them promptly. A wooden joist, or, if exposed to heat, an angle-iron bolted or clamped alongside of each flat rafter, would probably prevent such a collapse as occurred at the works of the Consolidated Gas Company, although if there should be any braces of round iron in the truss they also should receive attention.

OUR ARCHITECTURAL ILLUSTRATIONS.

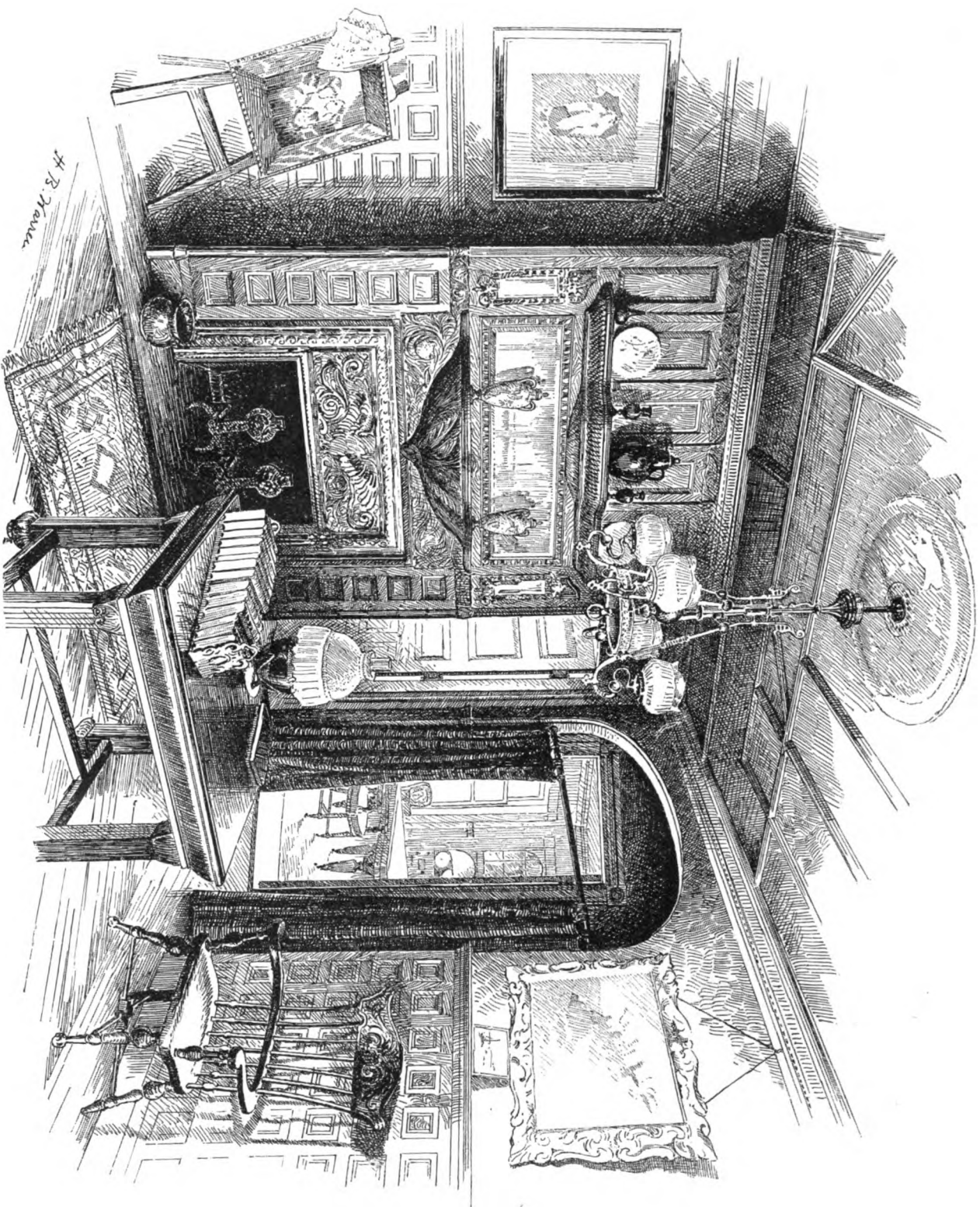
A HALL IN E. W. ANTHONY'S RESIDENCE, LONGWOOD, MASS.—E. A. P. NEWCOMB, ARCHITECT.

RESIDENCE AT WORCESTER, MASS.—W. R. EMERSON, ARCHITECT.

THE subject of our vignette illustration this week shows a residence at Worcester, Mass.

The first story is field-stone and walls and roof shingled and stained. The interior of the first story is finished in oak, ash, and cherry, and the second story stained pine. W. R. Emerson, of 5 Pemberton Square, Boston, Mass., was the architect.

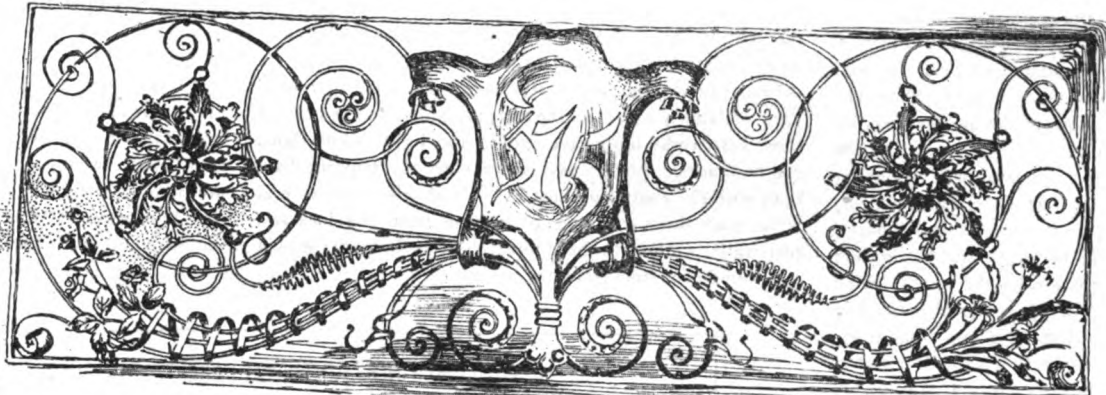
ORNAMENTAL IRON WORK, DESIGNED BY JACKSON ARCHITECTURAL IRON WORKS, NEW YORK.



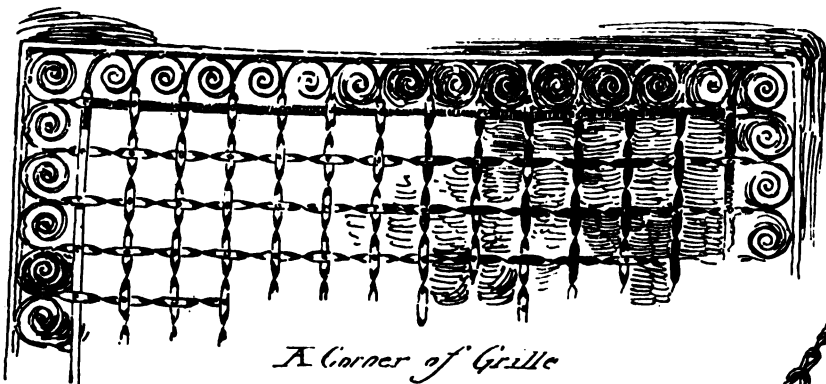
THE SANITARY ENGINEER & CONSTRUCTION RECORD ILLUSTRATED SERIES.

A HALL IN E. W. ANTHONY'S RESIDENCE, LONGWOOD, MASS.

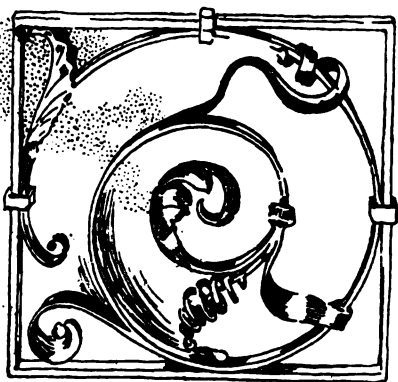
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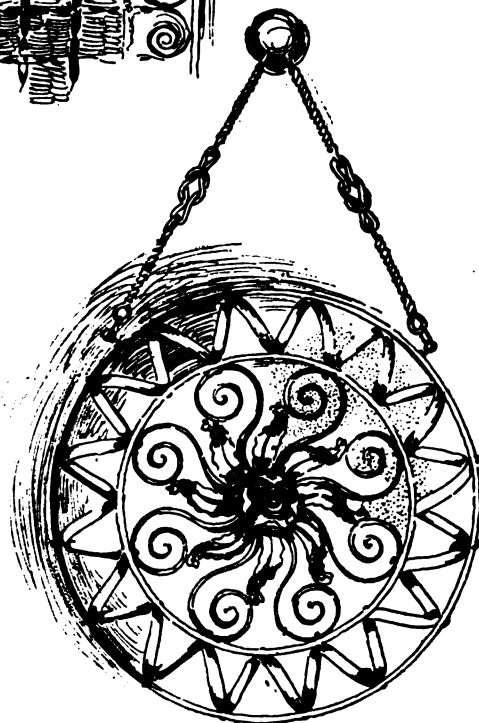
A Wrought Iron Grille



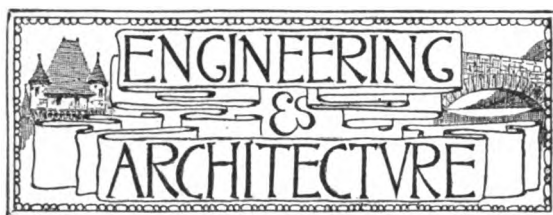
A Corner of Grille



*Designed and Executed by
Jackson Architectural
"Iron Works" N.Y.*



F.E. Waller.



THE KANAWHA RIVER IMPROVEMENT.

(Concluded from page 501, Vol. XIV.)

WE give now the cuts promised in our previous article. Figure 1 gives a good idea of the appearance of dam No. 6 when full, taken October 9, 1886, soon after completion and before the *debris* of the coffer-dam had been removed from below the weir. The view is taken from the abutment at the end of the weir looking toward the lock. It shows clearly the lock, the navigation pass next adjacent, and the weir; the lengths *across the river* being respectively about 90 feet, (the lock chamber is 55 feet wide in the clear) 250 feet, and 310 feet. Figure 2 is a section through the weir, and Fig. 3 a section through the Navigation Pass. This latter shows quite clearly the way in which the wickets are held in position. It shows also the axle at the lower end of the bridge trestle, about which it revolves sidewise when lowered down to give a clear waterway; also the anchoring of the sills, etc. It will be noticed that the sill of the weir is three feet above low water, and that of the Navigation Pass $2\frac{1}{2}$ feet below the same. It will be noted that the sill in the weir against which the wickets rest is of cast iron, and it is considered a great improvement over the use of timber. Figure 4 shows a view next to the lock in a section of the coffer-dam for the construction of Navigation Pass. The foundations of the pass are here shown nearly completed; one wicket and one bridge trestle are standing, also several of the horses and props ready for the wickets. It also shows a number of the slides and hurters in position.

Figure 5 is a nearer view of part of Fig. 4. It shows one of the wickets balanced on its prop, also other horses and props ready for the wickets, and one of the props, etc., down on the bed, as it is when the waterway is left clear. In the same manner the trestles also are lowered sidewise flat on the bottom in times of freshets or ice disturbance.

Figure No. 6 gives exact views of three forms of hurter now in use. The original Chanoine hurters were introduced on dams 4 and 5 of the great Kanawha improvement in accordance with the best European practice when these dams were planned in 1875. In connection with them the tripping-bar is used for lowering the dam.

The Pasquean hurter is a modification, as appears by the drawings, of the Chanoine hurter. This improvement was made by Pasquean, a French engineer of the Ponts et Chaussées, and applied by him on the La Mulatière dam at Lyons in a pass 340 feet wide. The La Mulatière dam was completed in 1881. Some of the Pasquean hurters have been introduced on the Great Kanawha dams. The first were tried at Dam No. 5 in 1881. This dam is now operated partly with the improved hurters and partly with the Chanoine hurters and tripping-bar.

Dam No. 4 (completed in 1880) is still operated, as built, with the tripping-bar and Chanoine hurters. Dam No. 6, finished last year, has all Pasquean hurters and no bars.

The operation or use of the hurters will be readily understood from the drawings. When the dam is erect the end of each wicket prop rests against the face or shoulder (S) of its hurter.

With the *Chanoine hurter* it is *pulled* to one side by the bar, when the wicket, being free to fall, the end of the prop runs down the descending channel of hurter and slides to its place. In raising the wicket, the end of the prop is guided by the groove (P Q) and drops in its place against the shoulder S.

With the Pasquean or "stepped" hurter, the wicket is lowered by pulling it bodily up stream from the bridge. This, of course, draws the end of the prop away from the shoulder up stream until it drops from the step into the descending channel. The end of the prop is then guided to its place, both in lowering and raising the wicket, precisely as with the Chanoine hurter.

Pasquean's hurters have been modified for use on the Great Kanawha, as shown by the drawings, by the introduction of a block (B) on top of the step. This block causes the prop to drop from the step by a short and defined movement of the wicket, and saves considerable time in lowering the dam. The hurters have also been

improved on the Kanawha by widening the throat at X, experience at dams 4 and 5 proving that stones, etc., were apt to get lodged in the wedge-shaped throat of the old Chanoine and Pasquean forms and stop the prop and prevent the wicket from falling.

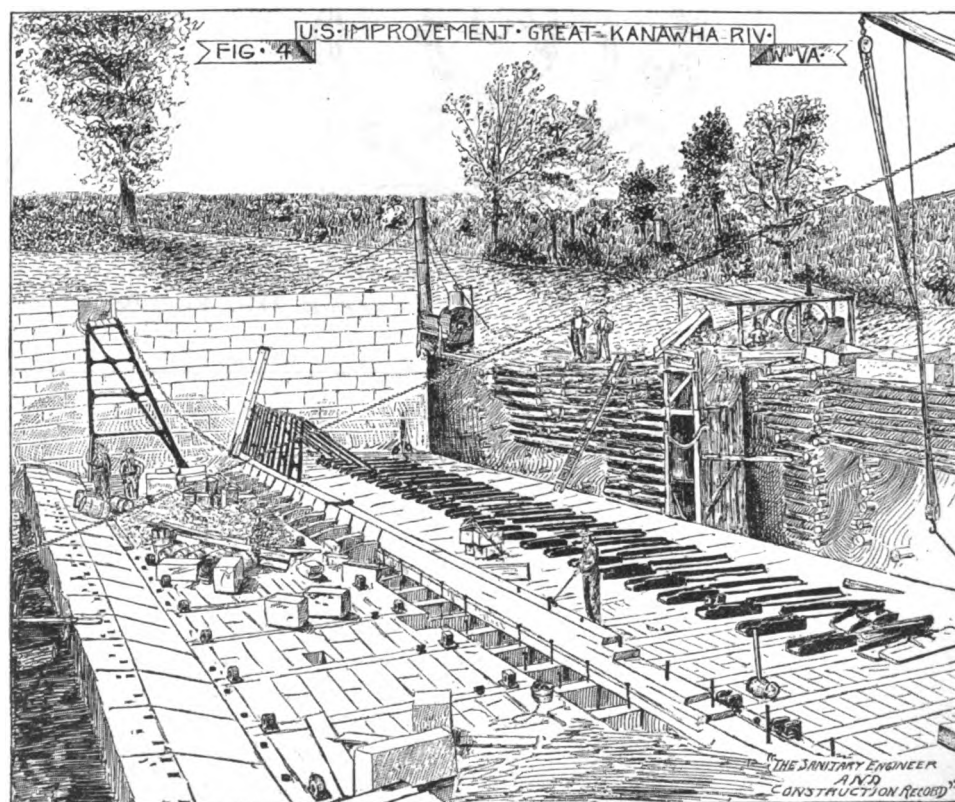
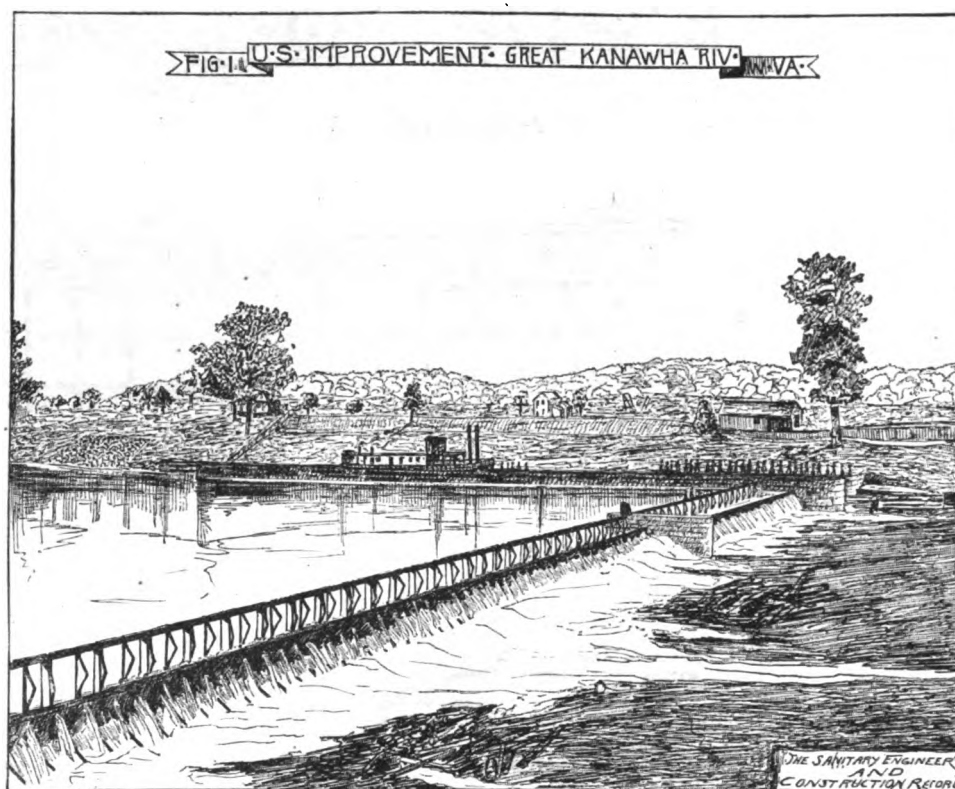
The advantages of the Pasquean hurter over the tripping-bars are important. The greatest advantage, as developed by practice on the Great Kanawha, is in *raising the dam*. With the tripping-bars some time is always required to clear the bars and gearing before the dam can be raised. This is avoided with the stepped hurters, and considerable time and labor of the lock hands saved. The Pasquean improvement is also simpler in construction and cheaper than the tripping-bars. The difference in the cost, as applied to one of the Great Kanawha navigation passes, is estimated at about \$2,000. This is on the basis of stronger and better bars and gearing than were used at dams 4 and 5, as the tripping apparatus at both of these first works built have proved too light. The dams can be *lowered* quicker and easier with the tripping-bars than with the Pasquean hurters. With the bars several wickets are thrown at once by gearing from the lock and pier-walls, while with the stepped hurters only one wicket is lowered at a time from the bridge.

The advantages, all considered, of the Pasquean hurters are admitted by the Government engineers connected with the Kanawha improvement, and have been fully acknowledged in their published reports, but Colonel Craighill, the officer in charge, considers these advantages not sufficient to justify paying the high royalty now demanded for the patent, and he thinks it probable that the stepped hurters will not be used at No. 7, the next movable dam to be built.

We insert the following paragraph from the *Kanawha Gazette* respecting the first movable dams in America:

"The great advantages of movable dams have long been recognized in Europe. In 1878 there were 124 movable dams in operation in France alone. The Great Kanawha had the honor of possessing the first movable dam in America.

"Dams Nos. 4 and 5 (the latter located at Brownstown, nine miles above Charleston, the other at Cabin Creek, six miles farther up), were completed in July, 1880, and have been in successful operation ever since. Dams 4 and 5 are both of the Chanoine type (the Davis Island Dam on the Ohio below Pittsburg, completed in 1885, is the same pattern), and although at Dam No. 6 a great many improvements have been made in construction and details, the



general principles of all three of the Kanawha movable dams are about the same. They are practically the same, too, as regards width of navigation pass and dimensions of the pass wickets. The pass wickets at No. 6, as before stated, are 13 feet 5½ inches long; those at Dams 4 and 5 are 13 feet 10 inches long. The Davis Island wickets are 13 feet long. The Great Kanawha wickets, with the exception of one dam in France, are thought to be the largest ever constructed."

The contrast of the broad, deep, placid pools, now seen on the Kanawha, giving entire safety to the vessels using them, with the tortuous, shallow stream, and the swift currents, before the improvement was made, is a very marked one; and what has been done here can be done in hundreds of other places in our country to the greatly increased development of its resources and the great benefit of trade in the vicinity of the improvements.

The names of the engineers and others identified with this work were given in the former article.

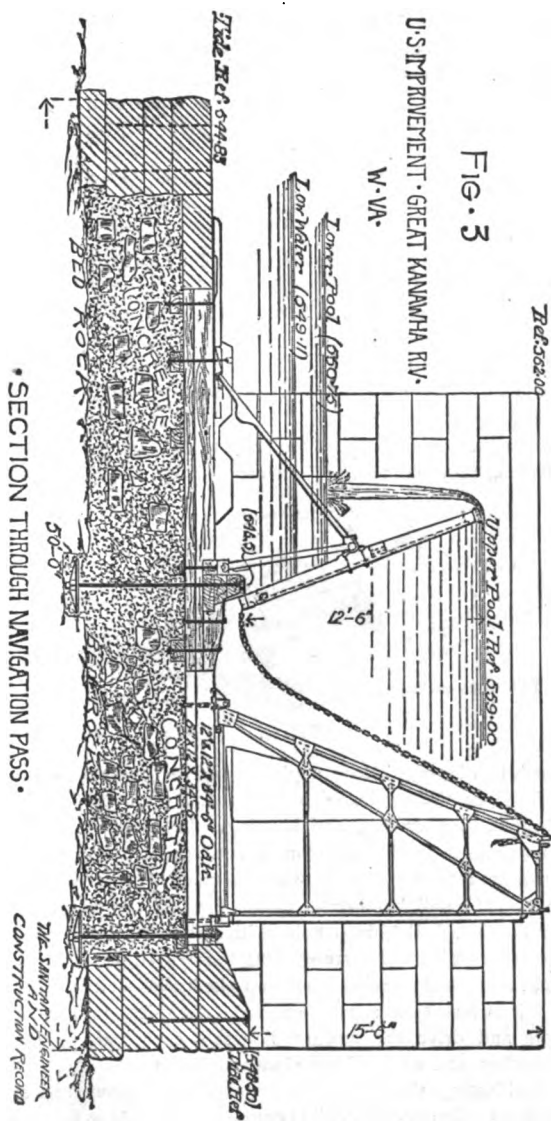
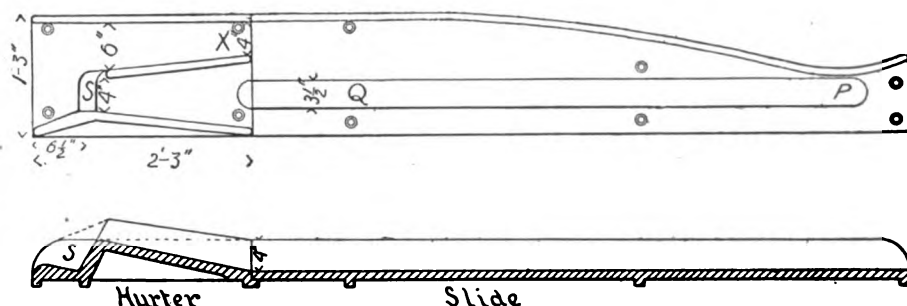
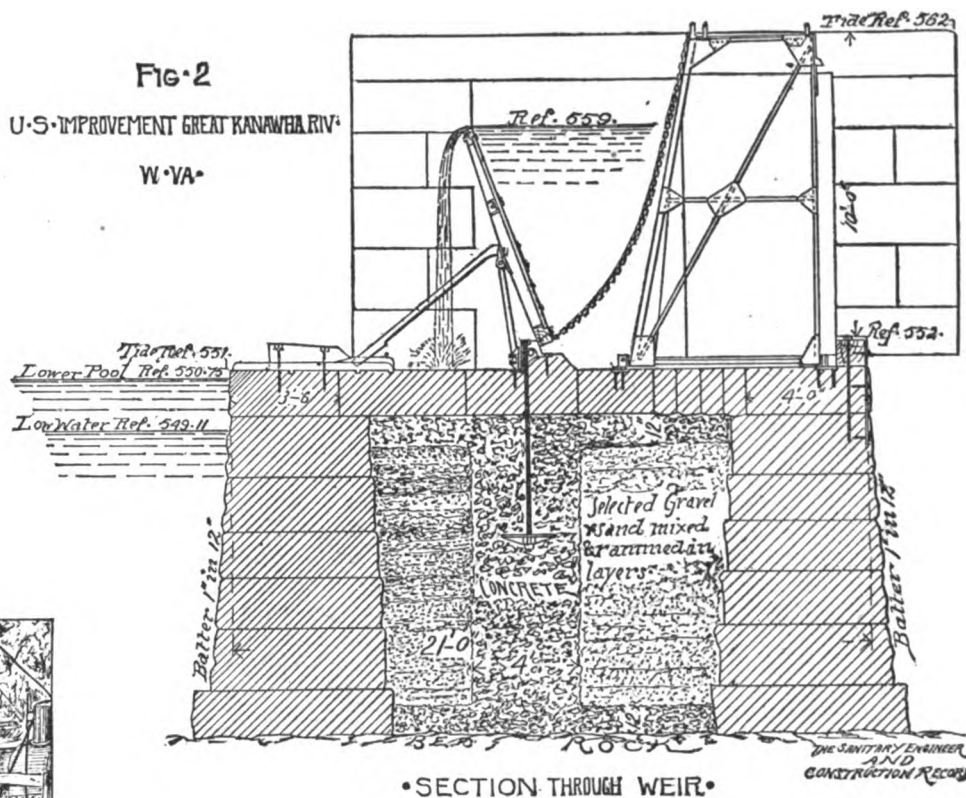
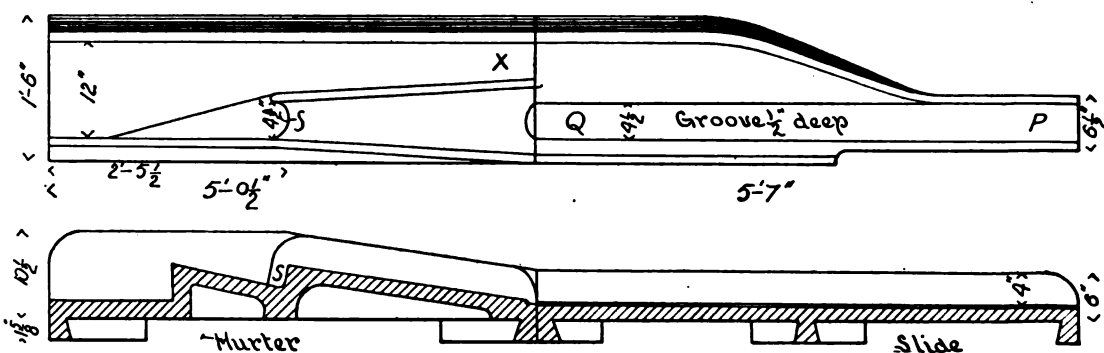


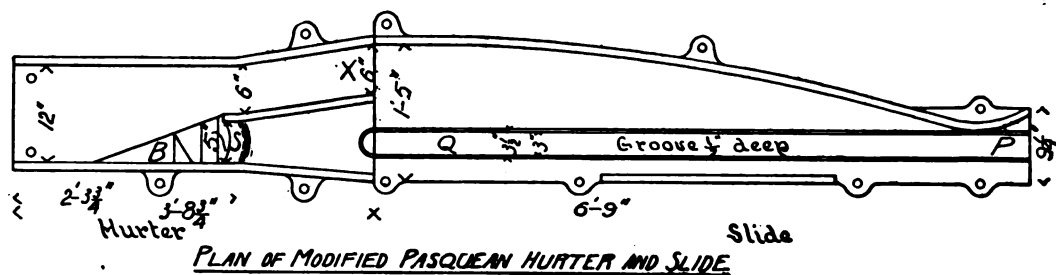
FIG. 2
U.S. IMPROVEMENT GREAT KANAWHA RIV.
W. VA.



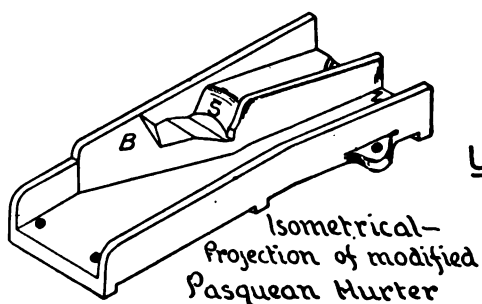
PLAN AND SECTION OF CHANOINE HURTER AND SLIDE



PLAN AND SECTION OF PASQUEAN HURTER AND SLIDE



PLAN OF MODIFIED PASQUEAN HURTER AND SLIDE



• FIG. 6 •

U.S. IMPROVEMENT GREAT KANAWHA RIVER

W. VA.

THE SANITARY ENGINEER
AND
CONSTRUCTION RECORD

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XXIII.

(Continued from page 518.)

THE TUBE RIVETING MACHINES AT THE FORTH BRIDGE.

[Prepared for THE ENGINEERING & BUILDING RECORD by E. W. Moir.]

THE main steel piers of the South Bridge cantilevers are composed of four braced steel tubes, twelve feet in diameter, having each ten plates in their circumference, with double-covered butt-joints at their ends and lap-joints with the adjoining plates on their sides. At the lapping of the plates on the inside of the tube are ten beams of fourteen sections (see Fig. 2), each formed of a tee and two angles, the head of the tee being held by the rivets passing through the lap-joints. As there are 1,600 rivets in each length of sixteen feet of the tubes, which are 350 feet long. Mr. Arroll, the contractor, designed a special hydraulic riveter to do the work. Figure 1 is a vertical section of one of the tubes, showing the riveter in place. Figure 2 is a sectional plan. G and G' are two heavy steel circular rings, spaced twenty feet apart, and are kept at their correct distance by angle-iron framing, which, when covered with small-mesh wire netting, makes a complete cage from which nothing can fall.

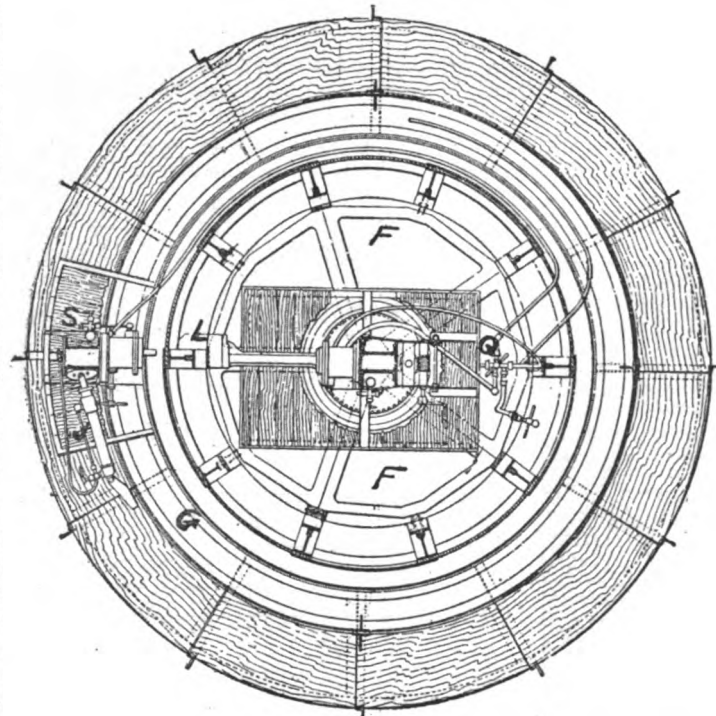
The rings are kept at their required distance from the tube by hard wood wedges driven in opposite the stiffening H-beams. R is the vertical riveting girder, which is held to the outer flange of the circular rings by cast-steel clips, but can be moved to any circumferential position by means of the small hydraulic jacks J. On the face of the girder, held in a cast-steel saddle, is the riveting cylinder, to which there is also attached a small platform for holding the men whose business it is to attend to the closing of the points of the rivets.

The saddle with its stage and cylinder can be raised or lowered to any height by means of the small hydraulic jack S, the cock controlling which is within easy reach of the men in the cage. Holes are provided in the face of the riveting girder, as well as round the circumference of the ring, against pins passed through which the ram is made to push when it is desired either to raise the cylinder or alter the radial position of the girder R. We have then on the outside of the tube a vertical girder movable to any position round the circumference of the tube carrying a cylinder which is capable of putting a pressure of forty tons on the point of any rivet on a length of seventeen feet. The inside girder does not travel bodily, but is made to rotate by suitable gearing within reach of the men on the small internal lifting platform, on trunnions at its ends. (See Fig. 1.) These trunnions are held in a central position by angle framing at the upper and lower ends of the girder (F, Figs. 1 and 2), which are wedged to the faces of the longitudinal stiffening-beams of the tubes, and rest upon the small movable brackets B, Fig. 1. The cylinder is in this case far from its work, but is provided with snap L with a movable cranked end so made to get in at the backs of the angles on the H-beams. (See Fig. 2.) The cylinder-platform and men are raised and lowered by a small hydraulic jack S, Fig. 1, in the same way as on the outer riveting girder. We have then inside a cylinder of the same power as that without, which can be brought to bear on the head of any rivet in a length of seventeen feet of the tube. The whole

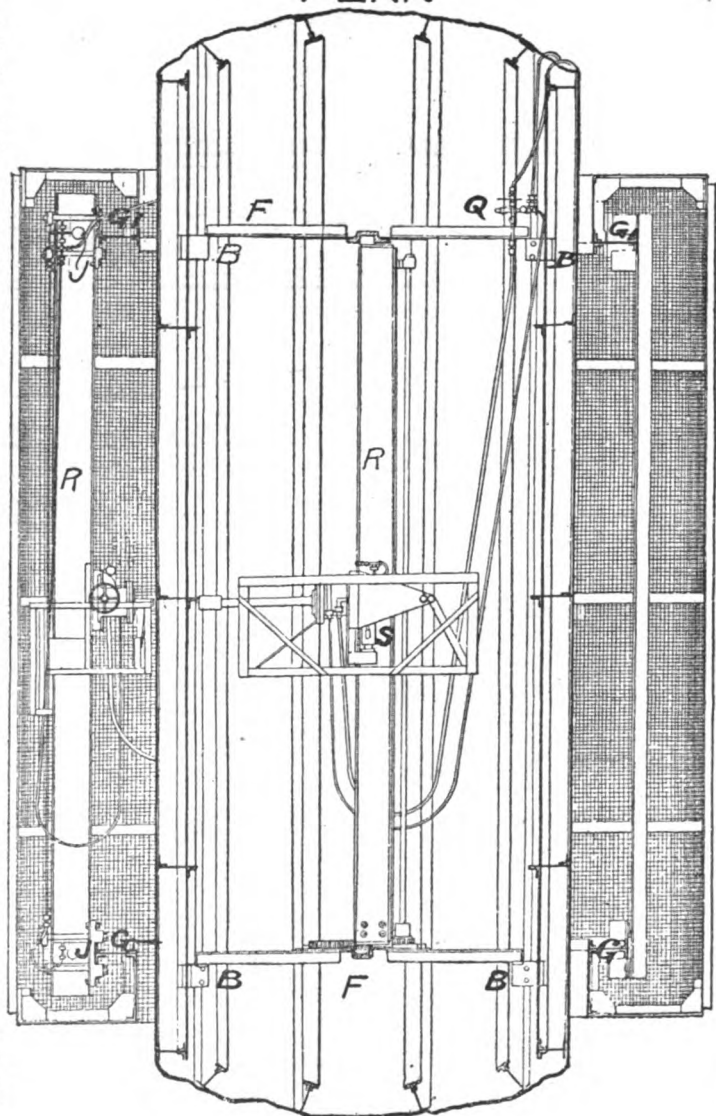
machine is suspended with platform above and is raised with it in sixteen feet stages, or sufficient to put on one course of plates. The water is admitted to both cylinders at once from one cock Q, but is delayed by a suitable valve from entering the outer cylinder until the rivet is well pushed into the hole from within. The rivets are heated in a specially designed oil-furnace just above the machine inside the tube, and have been put in at the rate of over 800 per day by unskilled laborers. The pressure used is that which is supplied throughout the works—namely, 1,000 pounds per square inch, carried to the various moving parts by flexible rubber hose.

[Other articles describing the plant used in the erection of this notable structure are being prepared for publication in this journal.]

(TO BE CONTINUED.)



PLAN

SECTION
FIGURES 1 AND 2.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

No. III.

BY WILLIAM R. BILLINGS, C. E.

Superintendent of Water-Works, Taunton, Mass.

(Continued from page 553.)

TRENCHING.

A TRENCH which is troublesome on account of caving grows worse the longer it is open; if, therefore, the trenching-gang is a good distance ahead of the pipe-layers, and water and quicksand are found within two or three feet of the surface, it is wise to send the diggers ahead on to dry ground, or make some other arrangement, so that the last two or three feet in depth of the wet trench will not be opened until pipe can be dropped into it. When caving occurs in wet, heavy ground some warning of the impending trouble is given by cracks in the surface, running nearly parallel to the side of the trench; but in sandy gravel the drop comes without warning and men may be seriously injured. In any case the tendency to caving is increased by the weight of the excavated material piled up on one edge of the trench, and if circumstances will permit it is well to keep men on the bank to shovel back the material as fast as it is thrown out.

In soil that will allow it, tunneling will often save the public and individuals much inconvenience by carrying the trench under crosswalks, driveways, and railroad crossings, and the only tools needed are the tunneling-bars, mentioned in the list of tools, and long-handled shovels. A little practice and boldness in this detail will give very satisfactory results.

In these cases, bell-hole digging and joint-making must be done together, and some suggestions upon this detail will be given later.

With cast-iron pipe, when the digging is good and the trench stands up well, it pays to put three, four, or half a dozen men at work digging bell-holes; that is, enlarged places in the trench, spaced so as to come about the joints of the pipe, and large enough to give a man room to swing his hammer and get at all parts of the joint without unnecessary fatigue. There is little or no danger of getting the bell-holes too large, and plenty of room for the calker will do not a little toward insuring tight and strong work. The bottom of the trench should be dug out eight or ten inches for a length of four feet beyond the joint, and the sides worked out on the same scale to give ample shoulder room. These directions will have a queer sound when one is trying to make joints in quicksand, and at such a time fixed rules amount to but little. No end of grit, plenty of hard work, with some little planning will make joints in places that seem all but hopeless for the first half-hour.

Neither stony nor rocky trenches offer any serious difficulties, and even in ledge-work it is simply a question of time and money. If the bottom of the trench comes in rock which must be worked out by drilling and blasting, the ledge should be cut away to a depth which will allow sand six or eight inches in depth to be spread upon the rock, in which the pipe may be imbedded. If boulders are encountered which are too large to be taken out by the derrick, they should be well cleared from the confining

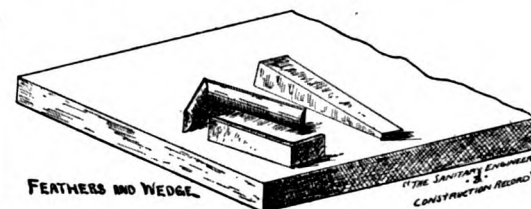


FIG. 14.

earth by digging before applying powder or dynamite; this gives the explosive a fair chance, and digging is cheaper than drilling and blasting. Large pieces may sometimes be worked off from a boulder or ledge which projects into the trench, without using explosives, by means of small hand-drills and "feathers and wedges." To do this, drill $\frac{3}{4}$ -inch holes with a short steel drill and stone-mason's hand-hammer along the desired line of fracture, eight or ten inches deep and six inches apart; drop a pair of feathers made of $\frac{3}{8}$ -inch $\frac{1}{2}$ -round iron into each hole and drive the wedges between each pair. The "feathers and wedges" are shown in Fig. 14.

In blasting, the nitro-glycerine preparation known to the trade as "forcite-powder" is comparatively safe and gives better results than common gunpowder, for it will shatter

rocks more thoroughly and with less tamping. To fire a $1\frac{1}{4}$ -inch hole three feet or more in depth, take a whole forcite-cartridge, cut off perhaps half an inch in length, and set a percussion-cap pinched on to the end of a piece of fuse into this short piece of the forcite by boring out a small hole with a knife. Lower this into the hole and cover it with the remainder of the cartridge broken into small pieces between the fingers, and fill up the hole with earth tamped down with a stick.

Such a charge as that will let daylight into any rock that a pipe-gang is likely to encounter, but the blast should be carefully loaded with logs, timbers, or railroad-ties chained together, and covered with brush to arrest small pieces which may do damage if allowed to fly. This forcite-powder may be used to loosen a troublesome boulder, by simply poking a hole into the bank along side of it and tucking in a little of the explosive folded in an envelope and held in place by a slight packing of earth, or a cracked and seamy rock may be thoroughly split by dropping an envelope full of the powder into one of the cracks, and firing by cap and fuse in the usual manner.

Rocks which appear in the bottom of a wet trench are unwelcome enough, but it will not do to leave them in such shape that a pipe will be supported by them in the middle with the weight of the back-filled earth bearing on the ends lying in soft ground. If the expense of getting out the rock seems too great, the depth of the trench should be reduced until a firm and even bearing can be secured.

On all trenches that do not stand up well or that must be made wide to get out rocks, the long three-legged derrick, illustrated on page 462, will be found exceedingly convenient, for its range is wide, and it can straddle fences in a right handy fashion.

PIPE-LAYING.

Cast-Iron Pipe.—When a hundred feet of trench has been bottomed out it is time to make up the derrick gang, and begin the work of putting the pipe into the ground. For six, eight, and ten inch pipe six men are enough, and they should be strong, active, and intelligent laborers. Men who are employed in this gang generally expect perhaps twenty-five cents per day more than the average digger, and good men in the place are worth it. It is not well to let the fellows who may be first chosen for this gang think that they are indispensable, and if one of them happens to be off a day, do not hesitate to take any good man out of the trench to fill the vacant place.

The first thing that a green lot of men must learn is to raise and carry the derrick, assuming that it be of the three-legged style referred to in a previous chapter. It is to be raised, first, just as a ladder should be, by footing the bottom and walking it into an upright position; then let one man grasp the pin of the middle leg with one hand and the leg with the other, a man at each of the other legs holding them firmly, and carry it straight away five or six feet; spread the other two legs the same distance, and the derrick stands alone, though perhaps not very firmly. A little study of the structure will now show that the legs may be spread as far apart as need be, provided always that lines joining the feet of the derrick form either an isosceles or an equilateral triangle, the line joining the two outside legs being the base. In placing over the trench, the middle leg should stand on the side which has the largest quantity of earth piled upon it. The man who is to carry the third leg, as the derrick is moved along from pipe to pipe, should grasp the pin firmly when the time for moving comes, throw his weight towards the trench, and be careful to keep midway between his comrades who are carrying the outside legs, and they in turn should walk as close to the edge of the trench as practicable, resist the push of the derrick firmly, and keep about ten feet apart.

A man at each leg, another to carry the rope, and two men in the trench, make an ordinary derrick-gang; for handling 16-inch pipe more men will be needed in hoisting and placing. The smaller sizes of pipe can be brought from the side of the road to the trench by means of the carrying-sticks. These sticks thrust into a pipe give good lifting hold, and two stout fellows at each end, shoulder to shoulder, will carry 4-inch easily, and 8-inch without overwork. Skids of 4x4 spruce thrown across the trench may support the pipe while the derrick is put in place over it; a sling of rope is then to be passed around the pipe enough nearer to the bell than to the spigot end, to cause the spigot end to fall easily into the trench when the pipe is lifted by the tackle from the skids. As the skids are removed to allow the pipe to be lowered into the trench, let one of

the gang bunt the pipe with the end of the skid to clear the pipe from sticks, stones, and dirt. This is not enough, however, and it should be the duty of the men in the trench to look through the pipe as it comes down to them and make sure that no one has either maliciously or carelessly left therein an old hat, or a pair of boots or overalls. These remarks are not in jest, for just such combinations of what the doctors might call incompatibles have been made.

As the pipe is lowered, one of the trenchmen enters the spigot into the preceding bell, his comrade assisting as best he can, but before the pipe rests on the ground it is well to swing it like a ram against the pipe already laid to make sure that the joints ready for calking are all "home." As soon as the pipe rests on the bottom, the foreman should straddle the trench at a convenient point ahead of the derrick, align the pipe just laid, and look back over the line for joints which may be improved.

The trenchmen should carry bars with them to throw the pipe, and not try to use shovels for levers. Attention should be given to vertical alignment, as well as horizontal, and if grades are not given by an engineer, and no use is made of a carpenter's level on the pipes, the vertical alignment may be kept within bounds by keeping the joints of the same width at the bottom as at the top. If the bell end of a pipe when it rests on bottom is found to be too low, raise it with the derrick, throw rather more than enough loose dirt under it, and then drop the pipe down hard on this two or three times. As soon as the pipe is in position a few shovelfuls of earth should be thrown on to the centre of it to hold it, and if the trench is bad, the section between the joints may be half-filled at once, as this will support the bank and counteract any tendency to caving. With 4 and 6 inch pipe and a troublesome trench, two or three lengths may be put together on the bank, the joints made on dry land, and then with two derricks and careful slinging three lengths may be put into the trench at once without straining the joints. The few joints that must be made in the trench may, in quicksand, seem at first like hopeless cases, but persistence and no thought of ultimate failure have conquered the most cases that have come in the experience of the writer. In such instances it is useless to attempt to get the sand down so as to make the joint right through without stopping to dig out again. Let the calker stand on the pipe while a good man with a shovel, perhaps a lot of sod, and some pieces of plank clears away and holds back the stuff so that the joint may be yarned if not poured. If the sand rises as soon as the shoveling ceases, let the calker do all he can by quick work, and then rest while another attempt with planks, sod, pails, and shovels is made to make room for him. In general, whatever means are employed to make and maintain room for joint-making in quicksand, let the preparations be thorough; let the plank be driven as deep as possible and well-braced, sods provided in large quantities; have pails or a good ditch-pump, and good strong men who are not afraid to "pitch in."

In order to locate gates or special castings in a particular spot or to bring a joint into a more accessible location it is frequently necessary to cut pipe.

For this use an 8 or 10 pound sledge and the long-handled cutting-off tool illustrated in Chapter I.; put a skid under each end of the pipe, placing one directly under the line of cutting and get a firm and even bearing on the ground for its whole length. A line for the cutter to follow may be had by winding the end of a tape-line about the pipe and marking along the edge with chalk, but a little practice will enable one to guide the cutter as the pipe is slowly rolled on the skids, so as to make a square cut. The blows of the sledge should be rather light for the first time around, and then when the cut is well marked so that it may be easily followed, the blows may be swung in with vigor.

The pipe should at some stage of the work be carefully inspected for cracks, which are oftenest found at the spigot end. If a crack in a spigot end is very slight and so short as to be more than covered by the bell, we may not think it worth while to cut the pipe, but a long crack obliges us to waste nearly twice its length of pipe, for the cut must be made at least six or eight inches above the visible end of the crack, and even then the jar of cutting may cause the crack to run still farther into the sound metal.

(TO BE CONTINUED.)

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING was held at the Society Rooms Wednesday evening, October 19, Past Vice-President W. H. Paine in the chair.

The first paper, presented through Mr. E. P. North, was on "Brick-Making in Sinaloa, Mex.," by Juan Josa Avela, Professor of Engineering in the Colegio Rosales, Cuiliacan.

The writer states that the material chosen is alluvium from banks of rivers that do not contain too much sand, and experiments are repeated to determine proper proportion of dung (horse or mule) to mix with it, to prevent bricks from breaking when placed in the sun to dry.

A drying-floor is prepared by leveling the ground and sprinkling with sand, then a shallow pit is excavated three or four yards square, in which the clay, dung, and water is mixed until plastic, then left until next day before prepared into bricks. The working force is divided as follows: four men carry tempered clay to drying-floor; two men to mold into brick; one man for turning them to permit even drying; two men carry bricks to kilns, and two men to stack in kilns, which contain 20,000 to 30,000 bricks. The arches of the stack for burning are adobe or sun-dried bricks 24x16x3 $\frac{1}{2}$ inches.

The following are names of bricks burned: Adovu, or common size, for house-walls, 18x9x3 inches; Ladrillo, for inside of ovens, thin walls, etc., 9x4 $\frac{1}{2}$ x2 $\frac{1}{2}$ inches; Tejas arqueados, for roofing-tile, 14x9x3 $\frac{1}{2}$ inches; Lozeta, or paving-tile, 10x10x2 $\frac{1}{2}$ inches. The standard price of the Adovu is, in the district of Sinaloa, \$8 per M.; at Fuerte, \$14 per M.; in Cucincau, \$10 per M.; in Mazatlan, \$18, and at the mines the price is often \$30 per M.

The roof-tile receives more care in fabrication and burning, which is done in square kilns, with walls eight to nine feet high, the floor being constructed of arches to hold the combustibles; but not more than five courses of tiles are burned at one time, and are handled with great care before burning. The fire is increased gradually until the smoke that settled on the walls of the kiln at first has burned off, and the tiles are vitrified, which is known by their becoming bright red. One thousand of these tiles cost from eight to twelve dollars, and are laid so as to cover a surface of 194 square feet, at a cost of five cents per square foot.

Mr. Flagg stated that the walls of Lima, Peru, were made of adobe blocks in the sixteenth century, and when taken down by Mr. Meiggs, after remaining in the wall three hundred years, were sold for a higher price than new blocks cost.

The next paper read by the Secretary was a description of the "Results of some Experiments of the Influence of Fineness of Sand upon Cement Mortars," by Emil Kuich-jing, C. E.

Owing to the constant differences with the contractors on the Public Works of Rochester, N. Y., as to the merits of cement and sand, they had tests made in the laboratory of Cornell University covering the following points:

First—Relation of the two brands of cement forwarded.

Second—Relation of the different sands forwarded.

Third—Amount of fine material admissible in these sands causing appreciable deterioration of mortar.

Fourth—Probable cause of deterioration of fine material that occurs in excess of amount so determined.

The two brands, Akron and Buffalo, were mixed with the standard pure quartz sand and also with fine-grained sand in the proportion of 1 cement 3 of sand, with the following result:

Cement, 1 part.	Same, 3 parts.	Tensile strength in lbs. per sq. in. after			
		3 Days.	1 Week.	2 Weeks.	1 Month.
Buffalo	Quartz.	16	75	31	51
Akron	"	11	11	16	32
Buffalo	Fine.	9	17	26	30
Akron	"	7	12	18	23
Buffalo	Neat.	133	127	145	173
Akron	"	113	119	125	149

Both brands stood the prescribed test for blowing.

It was found that 20 per cent. of material so fine as to force through sieve No. 5, having 170 meshes per lineal inch, could be admitted without sensibly injuring the strength of the mortar made in the proportions of 3 to 1.

Careful determination of the voids in the different sands and also of the voids in the cement were made, and upon carefully comparing the various results obtained it would seem as though the following conclusions were justified:

First—In making mortar with any of the above sands the cement in the proportion of 3 to 1 the voids in the given quantity of sand are not completely filled by the cement.

Second—Having given a sand consisting of a mixture of coarse and fine particles, these latter tend to decrease the voids in the sand by acting as a filling material, and therefore this sand will give a better result when used in making mortar 3 to 1, with the fine particles present, than it would if the fine particles were withdrawn by sifting.

Third—If, however, more than 20 per cent. of weight consists of fine material, this decrease in the voids is no longer noticeable, and the excess of water which must then be used to mix the mortar causes an additional temporary weakening of the latter. It was discussed by George S. Greene, C. Tompkins, C. E. Emery, and others.

The next paper read was by Mr. E. B. Noyes, a Resident Engineer on the Erie Canal, near Syracuse, which described some singular results obtained from tests made of different brands of cement. The writer states that the tests were not sufficiently extended to authorize any very absolute conclusions to be drawn, but are interesting. No. 1. The samples were made from different cargoes, but the six-months' test entirely from one lot. No. 2 were the results of 8 breakings, slow-setting and nearly 2 hours in taking $\frac{1}{4}$ wire and $3\frac{1}{2}$ hours for the $\frac{1}{2}$ wire. Fineness No. 50 Sieve, 84 per cent.; No. 100 Sieve, 73 per cent. In No. 3 there were also 8 samples prepared with fresh water and 6 samples with brine. Fineness No. 50 Sieve, 88 per cent.; No. 100 Sieve, 77 per cent.

For No. 4 there were eight tests with fresh water and six tests with salt.

For No. 5 there were eight samples.

For No. 6 a portion was made from cement fresh ground. A portion of same lot was put in paper bags and kept in testing room three months. The remaining part was spread in the air and stirred daily for fifteen days. The result of tests 3, 4, and 6 indicated that strong brine weakens cement more or less, but all brands tested are not affected alike.

No. 1.—Bangs & Gaynor.

Proportion	1 day	1 week	1 mo.	2 mos.	3 mos.	4 mos.	6 mos.
Neat	40	54	72	111	142	139	194
Brighton, 1 to 1	63	100	137	174	182	352	380
Phoenix, 1 to 1	40	54	100	137	174	182	352
Fayetteville, 1 to 1	61	117	168	266	310		
Crushed Quartz	62	122	196	266	310		

No. 2.—Akron.

Quartz, 2 to 1	127	199	248	307		
Quartz, 1 to 1	134	185	258	305	307	
Neat	135	201	248	245		

No. 3.—Buffalo.

Neat	82	155	230			
Quartz, 1 to 1, salt	85	180	238			
Quartz, 1 to 1	131	224	344			
Neat	164	206	321	333	326	

No. 4.—Norton.

Proportion	1 Day	1 Week	1 Mo.	2 Mo.	3 Mo.	4 Mo.
Quartz 1 to 1	72	122	184			
Neat	75	120	178	272	418	
Quartz 1 to 1	78	151	239	331	476	

No. 5.—Howe's Cove.

Neat	65	91	109	134	
Quartz 1 to 1	125	198	257	283	

No. 6.—Bangs & Gaynor.

Neat	26	68	93	114	Fresh ground.
*Neat (salt)	29	123	197	203	205
*Quartz 1 to 1	29	73	136	178	196
†Neat		123	169	164	176

* 3 months old. † Spread in air 15 days.

The following additional subscriptions have been received for the building fund:

Amount previously reported	\$8,112.00
Pedro J. Losa	100.00
F. J. Cisneros	200.00
J. F. O'Rourke	50.00
A. F. Kirtland	25.00
J. Imbrie Miller	134.50
F. L. Griswold	100.00

Total to October 18.....\$8,721.50

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE regular monthly meeting of the Boston Society of Civil Engineers was called to order at 7:30, October 18, by the President, L. Frederick Rice, at the society's room.

Professor L. M. Norton, of the Institute of Technology, read a paper prepared for the society by the late

Professor William Ripley Nichols, entitled, "The Action of Boston Water on Certain Sorts of Service-Pipes" (iron, lead, galvanized iron, and kalmlein).

Professor G. F. Swain gave a talk on matters regarding the dimensions of bridge structures. There were 44 members and 9 visitors present.

AMERICAN PUBLIC HEALTH ASSOCIATION.

THE American Public Health Association will convene at Memphis, Tenn., Tuesday, November 8, at 10 o'clock A. M., and continue four days. The meetings will be held in Young Men's Hebrew Hall.

The Executive Committee have selected the following topics for consideration at the meeting: (1) The Pollution of Water-Supplies; (2) The Disposal of Refuse Matter of Cities; (3) The Disposal of Refuse Matter of Villages, Summer Resorts, and Isolated Tenements; (4) Animal Diseases Dangerous to Man.

It is hoped that sanitarians, and others who have had experience and observation in these matters, will give their views to the association, and through it to the public.

The above selection does not preclude the presentation of papers upon other subjects; indeed, the Secretary has already been notified that papers upon other interesting topics will be presented. The association will therefore probably receive and discuss papers in all the chief departments of sanitary science.

The address of the President, Dr. George M. Sternberg, U. S. A., will doubtless be of great interest, following so closely the return from his South American and Mexican mission respecting yellow fever. It is expected the address will be largely upon recent work in bacteriology, in connection with private and public hygiene. Full reports are also expected from the various committees of the association. The Committee on Disinfectants will present a report, embodying the researches and experimental work of that committee during the year.

The headquarters of the officers and committees will be at the Gayoso. The first meeting of the Executive Committee will be held Monday, November 7, at 4:30 P. M. The subjects for each day's consideration will be stated the previous day, and an official programme will appear each morning. Ample time for discussion will be allowed under the rules of the association, and all discussions will be stenographically reported. The morning sessions will be adjourned at 2:30 P. M. daily, to permit the meeting of the Executive Committee, Advisory Council, and other committees.

Applications for certificates to enable members and those intending to become members, and their families, to obtain the reduced rates offered by the various railroad lines to Memphis, should be made without delay to the Committee of Arrangements, Dr. G. B. Thornton, Chairman, Memphis, Tenn. The Committee of Arrangements will immediately issue and mail to the members of the association a circular, giving information regarding reduced railroad fare, hotel rates, etc.; others will be sent a copy upon application to the chairman of that committee.

All papers offered the association become its exclusive property, will be copyrighted, and can only be published by consent of the Publication Committee. All reports and papers must be in the hands of the secretary by November 7, in order to receive the approval of the committee. After November 1 all communications to the secretary should be sent to Memphis, Tenn., care of Dr. G. B. Thornton.

The secretary would like, at the earliest moment, the names of all members of the association who have died since the last annual meeting, in order that proper mentions may be made.

Clergymen, teachers, engineers, architects, builders, and all interested in the practical work of the association, are cordially invited to be present.

Ladies are especially invited to attend the evening meetings of the association.

Irving A. Watson, M. D., Concord, N. H., is the Secretary of the association.

THE Michigan Engineering Society was recently incorporated at Lansing. Professors Green, Cooley and Davis, of the University of Michigan, at Ann Arbor, are among the promoters of the organization.

THE New Jersey Sanitary Association will meet at Trenton on October 28 and 29.

THE FALL OF THE PAROCHIAL SCHOOL BUILDING IN HARLEM.

THE cause of this melancholy disaster is happily no mystery and its lessons are too sharp and obvious to be unheeded, for a time at least.

Seven men, including the builder, Father Kirner, a Roman Catholic priest, lost their lives, and a dozen others were more or less seriously injured.

On the 6th of September last application was made to the Building Department to erect a two-story brick school-house at 443 East One Hundred and Fifteenth Street, at a cost of \$10,000, to be 100 feet deep, and thirty feet wide and high. On October 17 the application was amended to permit the addition of two more stories, increasing the height to fifty feet. Meantime, however, and without permission, the building had been run up to nearly that height, and while Mr. D'Oench, Superintendent of the Building Bureau, was examining the amended application the building fell.

The causes of the disaster are sufficiently set forth in his report. He says, first, that the mortar was of but "medium" quality; second, that the side and rear walls were carried nearly three stories higher than the front wall, while the law allows a difference of but two stories in height; third, that the wall was recessed improperly and without permission; fourth, that the walls were not strongly braced nor anchored to each tier of beams; fifth, that the piers, columns, and girders that were to have supported the centre of the floor-beams were not in place, some "flimsy scantling" being temporarily used instead, and not even that in the cellar; and sixth, that the walls were carried to a height of three and one-half stories when the permit allowed but two. He adds, that the walls left standing show dangerously rapid and careless workmanship and that the vibration caused by the hoist-elevator doubtless accelerated the catastrophe.

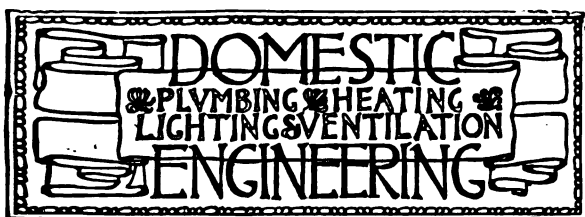
"Medium" is a very mild term to apply to this mortar. The bricks fell clean, and it was not easy two days later to find a lump of sufficient size and consistence to carry off as a sample. The inspector in charge of the district, Mr. William J. Martin, has since the accident officially reported that the mortar was of "first-rate" quality. He has probably done so on the strength of a statement, which in the same document he reports Father Kirner to have made, to the effect that he was going to erect a "good substantial building, as he was going to use it for a school."

Martin has since been dismissed on the following charges of neglect of duty: First, in failing to report unauthorized recesses in the walls; second, in failing to report that the building had been carried higher than the permit allowed; and, third, in failing to report that the side walls were more than two stories higher than the front walls. He pleaded guilty to the first only, although his own admissions convicted him of all three. The only palliation of his offence is given apparently without intention in the last part of the report of Mr. D'Oench, where he states that each inspector has on an average over 110 new buildings and alterations which he is expected to examine and report on each day.

Since the above was written we have learned that Martin has been arrested and held in \$5,000 bail.

ST. PETERSBURG EXHIBITION.

A PERMANENT technical exhibition and exchange has been opened in St. Petersburg, under the patronage of the Minister of the Interior and Public Works, and by the Association of Engineers of Ways of Communication, which seems to be worthy of being brought to the attention of the American people. It proposes to cover the entire field of civil, mechanical, and sanitary engineering, railroad equipment, and manufactures, each department to be in charge of specialists in that particular line. Its especial object purports to be the development of trade between Russia and foreign countries. The Russian Government has shown a tendency to construct its own great works, rather than to entrust them to private individuals or firms, and the Government is reported to be in need of quantities of various engineering supplies, such as will be exhibited in this display. The exhibition will also act as an agency to effect sales for exhibitors and others, and to facilitate the business of patent solicitors in securing Russian patents. Mr. A. Warschawsky, 14 Dey Street, New York City, has been appointed general agent for America. Particulars may be obtained of him.



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. III.

(Continued from page 554.)

FEED-WATER PIPES.

THE arrangement of feed-water pipes is as follows: Beginning at the feed-pumps W W—which are H. R. Worthington duplex—the feed-water is discharged through pipe X, which is three inches diameter and runs along the front of the boiler-domes to the heater R, the heated water returning by pipe Y, which runs parallel with pipe X, discharges the hot water to the several boilers through the branches 46, 47, etc.

When the heater is not in use the valves 48 and 49 are closed and valve 50 opened, then the feed-water goes direct to the boilers without going around the loop made by pipe X.

The feed-pumps and pump-governors Z Z will be more fully explained hereafter.

HYDRAULIC-ELEVATOR WATER-SERVICE.

The elevator water-supply main is 16 inches diameter. Its position is fully shown in the cellar plan near pumps. (Fig. 1) and it is shown in cross-section in pump elevation, Fig. 2. Two of the three elevator pumps are constantly at work during business hours discharging their contents into it through 12-inch discharge-pipes. This main is tapped at five places, marked 51, 52, 53, 54, 55, by 10-inch pipes that go directly up the shafts adjoining the elevator-wells to the top of the building, where they are each connected to a pair of cylindrical tanks partially

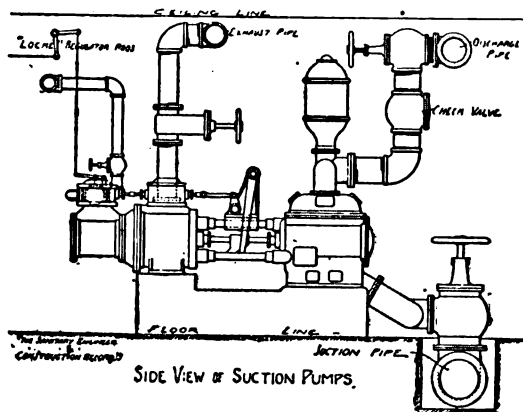


FIG. 2.

filled with water. In addition to these ten hydraulic elevators, water is supplied from this main through the 3-inch galvanized pipe marked 56 to the private elevator of the President of the Mercantile Trust Company, which elevator operates from the first to the "Equitable" floor. Another pressure water-main (57), which is connected to the branch marked 51, conveys water to operate the "ram" elevators 58 and 59 located in the offices of the Mercantile Safe Deposit Company's vaults, and used for hoisting and lowering valuables and coin from one floor to the other.

Still another pressure water-main, not shown, operates the private elevator of the President of the Equitable Life Assurance Society, the elevating mechanism for which is located on the ninth floor.

FILTERED WATER FOR HOUSE USE.

The system for supplying the offices and building generally with pure filtered cold water is very complete. The Worthington pump E, cellar plan, is devoted to this purpose. The suction is connected to the storage-tanks 62 and 63, which are supplied from the city water-mains. These tanks have a united capacity of 10,000 gallons, and are kept filled in case the city mains should temporarily fail in their supply. Water is drawn from them through suction-pipe 90 to pump E; thence is forced to tanks at the top of the building; thence, by a 6-inch main, back again to the cellar. The 6-inch main is

carried around the cellar, and, by risers, is connected to the different pipe-lines throughout the building. This enables the engineers in charge, in case of trouble in any part of the building or system, to cut off any single line of pipe from the cellar, avoiding the delay of going to the top of the building to shut off the water at the tanks, as is often the case, and leaving but a limited number of tenants without water, instead of cutting off a large section of the building.

The suction of the Worthington pump, D, is also connected to the storage tanks 62 and 63, and the discharge to the overhead tanks by pipe 91, in case the pump E should be disabled, its regular duty being for elevator use on Sundays and holidays, for which purpose the suction is also connected to the water tanks P P, as shown in dotted lines 61, while a separate discharge is connected to branch 54 of the water-main at 92.

Each hydraulic elevator has an independent supply-pipe seven inches in diameter running from the overhead tanks down the supplementary shafts adjoining the elevator-wells to the elevators located in the cellar, and shown in cellar plan. Although representing in the aggregate about 1,300 feet of pipe, they are simply designated on the drawing by ten very small circles. The horizontal part of these pipes are numbered 64, 65, 66, 67, 68, 69, 70, 71, 72, 73.

The three pipes to each pair of passenger elevators—viz., the 10-inch riser and the two 7-inch supply-pipes—all rest on two strong pieces of I-beam extending across the pipe-shafts from wall to wall. Some distance from the bottom of each discharge-pipe, corresponding with the height of the ceiling, is set a tee, from which connection is made to the elevators, in the most direct manner the walls of the building will allow, in each case.

Each elevator is also supplied with an independent 6-inch discharge-pipe running clear from the elevator to the elevator water tanks P P. These discharge-pipes are marked respectively 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, the figures being placed conveniently near the elevators. It is arranged so that each discharge-pipe will discharge into both or either of the tanks P P, so that if one tank is undergoing repairs, or being cleaned, the other can be made to do all of the work.

THE BOILERS.

The steam for all purposes is furnished by nine boilers, rated nominally at 100 horse-power each (see Fig. 3). They are set side by side in pairs, with one exception, and

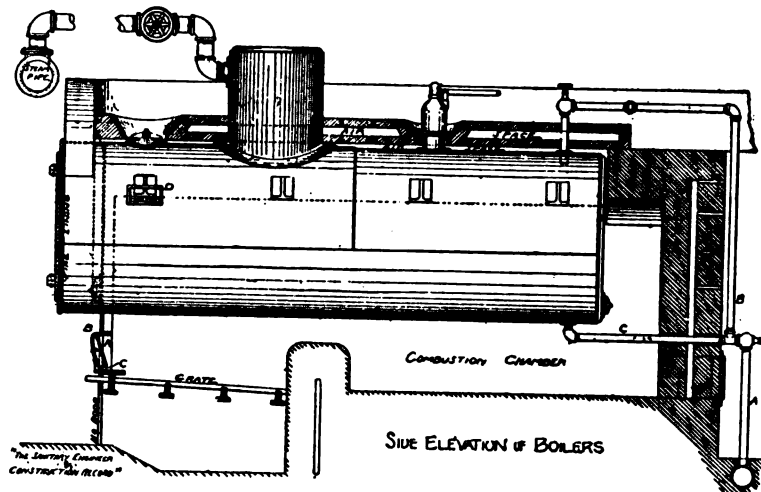


FIGURE 3.

are of the horizontal tubular pattern, 16 feet long by 5 feet 6 inches diameter, of $\frac{3}{8}$ -inch steel; each boiler is furnished with a dome 36 inches diameter and 36 inches high, and 58 4-inch tubes.

The heads are $\frac{1}{8}$ -inch flange steel; the longitudinal seams are double riveted; the calked edges of the sheets are planed beveling; all the rivet holes were drilled; no drifting was allowed; the tubes were ordered expanded by Dudgeon Expander.

Each boiler has a manhole 11 $\frac{1}{2}$ " x 14 $\frac{1}{2}$ ", and two handholes, one in front 11" x 8", and one in back 7 $\frac{1}{2}$ " x 4 $\frac{1}{2}$ "; both manholes and handholes are strengthened with heavy cast-iron rings, firmly riveted to the shell and heads.

Steam is delivered through 6-inch wrought-iron pipes tapped into cast-iron flanges riveted on the front of the domes near the top (see Fig. 3). These pipes connect with the 14-inch pipe already mentioned, which is suspended from the ceiling and runs the whole length of the building.

battery of boilers about 4 feet from the line of the boiler fronts. The feed-water pipes enter through the front head at a point below the lowest tube. The blow-off pipes, 2 $\frac{1}{2}$ inches diameter, are placed on the bottom of the shells just in front of the back heads; the exact arrangement is shown in Fig. 3. The pipe A leads to the sewer in the usual fashion, but the pipe B, leading to the top of the boiler and down into the steam-room, is an addition to the usual practice, which has been found by some nine years of trial to be a complete preventative against the filling up of the blow-off pipes with scaly matter.

The action of the device is as follows: Pipe C, being in a very hot and effective part of the furnace, keeps the water therein in a high state of ebullition as compared with the water in the adjoining part of the boiler; as a result the water is violently projected upward through pipe B, and deposited into the steam-room, thus making room for a constant inflow to pipe C from the water in the back end of the boiler. The device is the unpatented invention of Mr. Wilson, the superintending engineer. Its action seems to be all that is claimed for it.

Each boiler is furnished with a fusible plug at the water-line that will melt out when the water gets too low in the boiler. Eight heavy lugs are riveted to each boiler; they rest on 1 $\frac{1}{2}$ -inch rollers placed in box-castings, shown at D, that are built in the wall. A large door is placed in the back connection for easy inspection and cleaning.

The fronts stand out 15 inches from the boiler proper and are fitted for the Ashcroft grates and doors; the large front connection doors are lined with fire-resisting material put on in sheets 1 $\frac{1}{2}$ inches thick bolted into place. The pressure of steam carried is 80 pounds above the atmosphere; the boilers were tested by water-test to 150 pounds per square inch before delivery; they were put in place and connected up by the chief engineer's own men.

The connection to the chimney is made by one branch spanning two boilers and uniting in one rectangular flue 30x36 inches, and running along the top of the brick-work of the boilers to the back where they join the main flue, thence to stack (see cellar plan).

The main feed-water pipe for all the boilers runs along the front of the domes just below the 6-inch branch steam-pipes that connect to the 14-inch main. This pipe is 3 inches diameter and made of annealed brass tubing. The feed branches that lead over to and down the front of the boilers are also made of brass tubing, the object being to avoid the frequent repairs incidental to iron pipe when

used for that purpose. The usual combination gauge and water-glass stand is also of brass. A globe-valve is placed on each of the 6-inch steam-branches near the dome, and the pipes turn upward as high as the ceiling will allow, and down again to make connection on the top side of the 14-inch main. This arrangement forms an inverted U, and is done to allow properly for expansion.

All of the steam-pipes, flues, and other hot places are covered as completely as possible with non-conducting material furnished by the Magnesia Sectional Covering Co., of Philadelphia, Pa. This material is put on in sheets, which are held in place by iron-bound fastenings, so that it can be removed for repairs or changes.

(TO BE CONTINUED.)

ENGLISH PLUMBING PRACTICE.

BY A JOURNEYMAN PLUMBER.

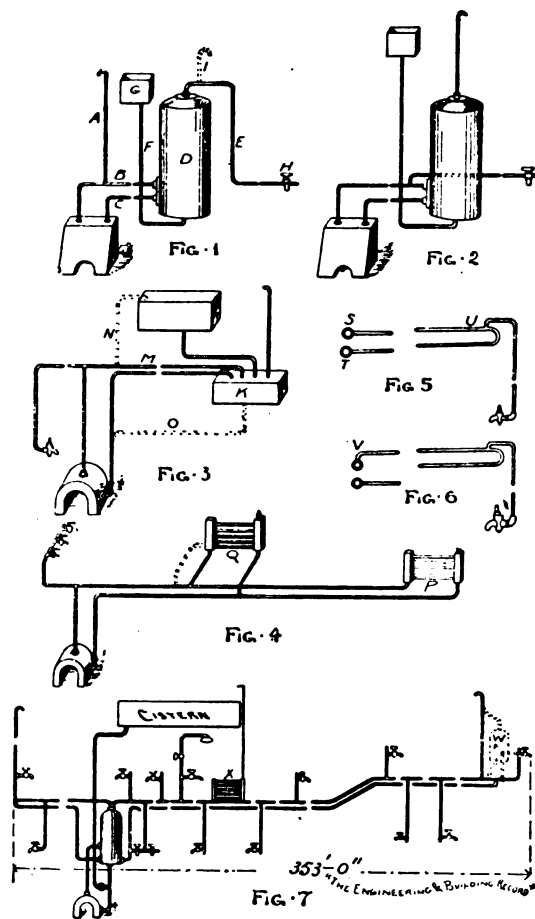
No. LXX.

(Continued from page 491.)

HOT-WATER CIRCULATION (CONTINUED).

TO CARRY out hot-water work in a thoroughly efficient manner, a man requires to know all the principles which govern his work. If he does not know these principles he is always liable to blunder in the arrangement of the fittings and pipes. A man may be a good tradesman and fix new work that will answer first-class and yet very often be at a loss to know how to alter other work that has been improperly done by some one else.

Figure 1 is an illustration of a job near Regents Park in London. A is a $\frac{1}{2}$ -inch expansion-pipe, B a $\frac{3}{4}$ -inch flow-pipe, C a $\frac{1}{2}$ -inch return-pipe, D a 30-gallon cylinder, E a $\frac{3}{4}$ -inch draw-off pipe, F a $\frac{1}{2}$ -inch cold-water feed-pipe, and G a small feed-cistern with a $\frac{3}{8}$ -inch ball-valve. The top of the feed-cistern was fixed nearly level with the top of cylinder. The talented expert who arranged this work was ignominiously dismissed, and another man was called in who spent several days in altering the work, but still could not see how it was that no water could be drawn at the cock H. Eventually, he fixed another expansion or vent pipe as shown by dotted lines at I, when he succeeded



in getting a small dribble of water at the bibb-cock. A large fire had been kept up, with the result that sometimes the water was forced out of the feed-cistern and steam drawn at the bibb-cock when opened. This was before the second expansion-pipe was fixed.

The second man having been sent away, the owner thought perhaps it would be an advantage to go to a respectable firm of engineers instead of employing cheap men who knew nothing about the principles which govern the work. He was very much surprised when he was told that the whole of the pipes would have to be changed to a larger size and differently arranged.

Figure 2 shows the alterations, which may be enumerated as follows: The pipe leading to the draw-off cock was branched into the flow-pipe from the boiler to the cylinder. The pipes between boiler and cylinder were made one inch in diameter. The expansion or vent pipe was fixed from the top of the cylinder and the feed-cistern was fixed at a higher level. A larger service-pipe and ball-valve were fixed, and also a larger pipe from the feed-cistern to the bottom of the cylinder. A damper was also fixed in the boiler-flue so as to regulate the draught. On being told that there was plenty of hot water and enough to supply a bath, the gentleman was so pleased that he had fixed in an adjoining room.

Figure 3 is an illustration of another blunder which was, if possible, worse than the last one described. This was fitted up in a nobleman's mansion in London by a village blacksmith, in whom his lordship had so much confidence that he paid railway and other expenses sooner than trust to any one in London. The strange part about this arrangement is, that the water in the cistern K did sometimes get hot, but was never to be depended upon for heating. At times it was found necessary to open the cock L, as air would accumulate in the horizontal pipe M. The only alteration made in this case was to fix a vent-pipe as shown by dotted lines at N, and connect the return-pipe from the hot-water cistern to the boiler as shown by dotted lines at O.

Figure 4 was a rather strange experience of erratic circulation. A boiler was fixed for heating water to supply sinks in which bottles were washed at a wholesale wine merchant's. Two radiators were fixed as shown in the diagram for heating the offices. The coil P got very hot, but there was no heat in the coil Q so long as there was a fire under the boiler. But on allowing the fire to go out the water would at once begin to circulate backwards and the coil Q got moderately warm, but on again lighting the boiler-fire this coil would gradually get cool again. As the whole of the work appeared to be done in good and workmanlike manner, some little thought was necessary before it could be understood why one coil got hot and the other did not, when the boiler-fire was alight, and yet on putting out the fire the circulation was reversed. The pet-cocks on the coil-heads were opened, but as water came in each case there was proof that they were not air-bound.

Two mistakes suggested themselves. One was the pipe from the boiler was too small, being only $\frac{1}{4}$ -inch, and the branch to the coil Q was at right angles, but horizontal. The return-pipe was branched into the main return-pipe as shown in the sketch. This branch being upright accounts for the back action in the circulation. The alterations made were as follows: 2-inch pipes were fixed from the boiler as far as the branches to the coil Q, and the flow-pipe branch was turned upwards as shown by dotted lines. The alterations, when made, proved to be successful, as both the coils heated equally.

In another case a long branch pipe was fixed to supply a pantry sink. This pipe was returned so that water would circulate through it, and thus avoid having to empty the pipe of cold water before hot could be drawn. It was found that no circulation took place. The way it was branched is shown at Fig. 5, S being the main flow and T the main return-pipe, and U the way the draw-off pipe was branched, so that any pent-up air could escape when the bibb-cock was opened. Figure 6 shows the alteration made, the branch flow being taken off the top of the main flow as shown at V. The issue was successful and hot water freely circulated through the branch pipe, which was about forty feet in length.

The last two problems in hot-water circulation are typical of a great many mistakes made by men who may be compared to pieces of machinery, who can execute work in a fairly good way, but who lack the necessary experience or knowledge to properly plan or arrange the scheme before commencing to carry it into execution. Other examples could be given, but those cited are sufficient to set the reader thinking, and, if he is a practical, man may perhaps prevent him making similar mistakes.

In some instances fire insurance societies insist that no hot-water pipes shall be in actual contact with, or within several inches of, any wood-work. Where of necessity the pipes must be fixed close, the wood-work has to be covered with sheet-metal or be otherwise protected.

When pipes are carried beneath wood flooring, and rooms, etc., are beneath, it is always advisable to construct a proper channel for the pipes to lay in, and line the channel with sheet-lead. This metal lining not only keeps the pipes away from the wood-work, but should the pipes leak, the water is caught, and, running to the lowest end, the bottom of the channel being laid to the same declination as the pipes, can be conveyed

away by means of a waste-pipe fixed from the channel to a suitable position for discharging. It is also a good plan to lay the hot-water pipes on small rollers, which can be made of remnants of iron pipe, so as to keep the circulation-pipes further away from the wood-work, and also allow them to move freely when expanded or contracted by differences in temperature. These rollers should not be too far apart, or the pipes will sag down between them, thus allowing air or vapor to lodge in the high parts and cause a partial obstruction.

It is important that the cold-water supply-cistern should be fixed a fair height above the highest draw-off cock, and, as stated in another chapter, that the cold-water supply-pipe should be a good size—that is, larger than any of the branch or draw-off pipes. This has again been brought to the writer's notice at a house where complaints were made that very often no hot water could be drawn on the upper or chamber floor for a minute or two at a time, when it would begin to run at the tap and perhaps immediately afterwards stop again. On seeking for the cause of this, it was found that sometimes one or two taps were opened on the ground floor for drawing hot water at the scullery or pantry sinks, during which time none could be drawn on the floor above.

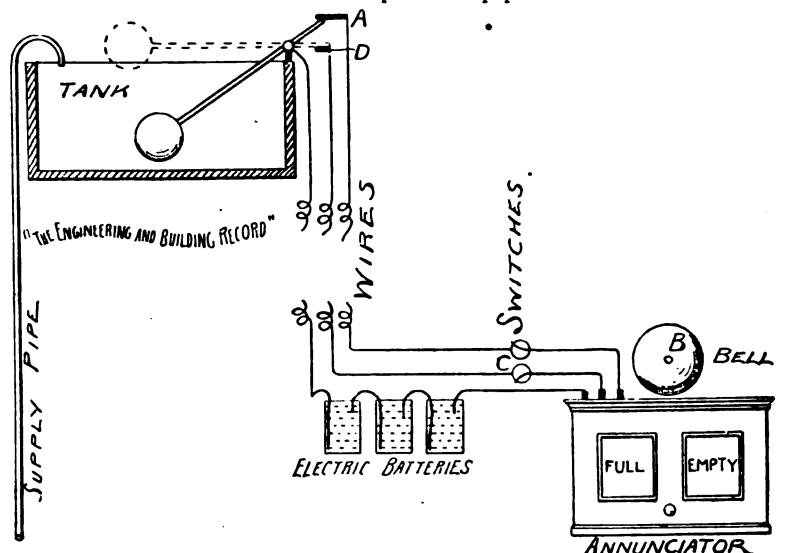
Figure 7 is a sketch diagram showing the position of the cold-water cistern, cylinder, boiler, tinned copper circulation and draw-off pipes, etc. To remedy the evil, all the cocks on the ground floor were pea'd—that is, a copper disk, with a small perforation, was inserted in the bosses, so that the water did not run quite so fast when the cocks were opened. A $\frac{1}{4}$ -inch pipe was fixed from the cold-water cistern to the boiler. The cold-water cistern was only four feet above the level of the highest draw-off cock, and this cock was one of great importance, as it supplied the principal bath-room, which was used by a nobleman. The above alterations were found to improve matters very much, but at times no hot water could be had at the above-named cock, so it was deemed advisable to fix a 20-gallon tinned copper cylinder, as shown by dotted lines at W, the circulation-pipes being so connected that the cylinder could only be emptied by opening the cock attached to it. This arrangement was to avoid the contents of the cylinder running back into the circulation-pipes when they were being drained by cocks at a lower level, and was found to be fairly successful, although some time had to elapse before the lower strata of cold water was heated to the same extent as the upper portion of the contents of the cylinder.

In the diagram X was a coil made of $\frac{1}{4}$ -inch copper pipes, nickel-plated, and was used for warming the bath-room, and also the bath-towels.

(TO BE CONTINUED.)

AN ELECTRIC WATER-TANK INDICATOR.

WE illustrate here an apparatus for indicating the depth of water in a tank, designed by a lad 16 years of age, now attending the high school in Boston—William A. Tucker, a son of Colonel Tucker, of the firm of Tucker & Titus, of that city. By reference to the sketch it will be noticed that when the tank is empty the end of the float-lever touches at "A," ringing a gong-bell "B," and at the same time causing on the annunciator the word "empty" to appear. The engineer can then turn the switch-valve "C" to stop the ringing of the bell, and start his pump. When the tank is full and the lever is released from "A" and touches "D," the bell rings again and the word "full" is shown on the annunciator. The switch is then turned again and the ringing of the bell stopped. It gives us special pleasure to illustrate the work of young men, and we hope our readers will bear this in mind and call our attention to their efforts in any department that comes within the scope of this paper.



HOW NEW YORK PLUMBERS MAY PROTECT THEMSELVES.

THE President of the Health Department of New York has sent the following letter to Mr. Alexander Lowe, Secretary of the Master Plumbers' Association, which is of interest to all connected with the plumbing trade. The plumbers have been very careless in the matter of ascertaining whether they are protected by the approval, in writing, of the plans and specifications furnished them, and have risked a great deal in beginning work subject to the approval of the board when it might suit the owner or architect to file plans. After the notice thus given them they will have no reason to appeal to the good nature of the Board of Health to help them out of the difficulties they invite by neglecting the simple precaution of ascertaining whether the plans and specifications are legally approved:

Mr. Alexander Lowe, Secretary Master Plumbers' Association:

DEAR SIR: Please call the attention of members of the Master Plumbers' Association, and, as far as possible, of the trade at large, to the importance of ascertaining whether the plans and specifications to which they are called upon to work are approved by the Board of Health in the shape in which they are furnished by architects and owners. This can be done by inquiry at this Department. When it is neglected, the plumber may unconsciously fall into a snare from which he may find it difficult to extricate himself. For example, a plumber about to begin work on a contract to pipe four buildings called at Department Headquarters a few days ago to make sure that the specifications furnished him were duly approved. Upon examination it was found that the specifications had been originally approved for a house which was never built, and had been altered by some unauthorized person and made to cover four houses in another location. These specifications were approved under the old rules, and had work been begun it would have been stopped as soon as the violations were discovered and reported by one of our inspectors. This would have entailed inconvenience and loss to the plumber, and it would have been impossible for the Board of Health to have done anything for his relief during the proceedings against the owner. Instances have also come to our notice in which the specifications furnished the plumber to bid on and work from have been very different from those approved by the board. The plumber under such circumstances might be guilty of wrong intent, but he would be none the less seriously compromised by his position, and could not avoid inconvenience and loss. The Board of Health cannot overlook violations of the law, even where the plumber honestly believes himself to be working from approved plans and specifications. We offer him every facility to advise himself in advance as to what the board has approved, and the protection thus secured is worth all the trouble involved in the inquiry.

Attention is also called to the fact that, under the new rules, the approval of the Board of Health is withdrawn if work is not begun within six months of the date of such approval, and that plans must again be presented for approval if subsequently made use of.

By promulgating this information the best interests of the trade will be served. Under the law it is a misdemeanor for a plumber to proceed with new work, "unless the plans have been previously approved in writing by the Board of Health." It is our duty to enforce this law, and we shall be compelled to proceed against plumbers who violate it.

Respectfully,
JAMES C. BAYLES, President.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

ON THE DISCHARGE OF STEAM INTO SEWERS OR SOIL-PIPES.

OFFICE OF THE SEWER COMMISSION,
AMSTERDAM, N. Y., October 13, 1887.

SIR: Several specifications for plumbing contain the following: "No steam-exhaust, blow-off, or drip-pipe shall connect with the sewer or any house-drain, soil-pipe, or waste-pipe." To settle a difference of opinion, will you please give me your ideas as to connecting blow-offs and drip-pipes with a modern system of small-pipe sewers? Yours respectfully,
WILLIAM B. LANDRETH.

[The connection of steam and sewer-pipes is very objectionable for two important reasons—first, on account of the damage which may be done to a brick or cement-pipe sewer, and especially to the joints of the latter by the steam or hot water, which also injures lead joints in iron pipe, the iron expanded by heat compressing the lead and causing the joint to leak when cool; and second, that if the steam is discharged in sufficient quantity it escapes through every opening, carrying with it the deleterious emanations of the sewer.

If for any reason it is not convenient to dispose of the steam and hot water otherwise, they might be conducted to a well-ventilated cesspool through a sufficient length of exposed pipe to insure complete condensation and reasonable cooling. The discharge from such a cesspool could be safely received by the sewer.]

HEATING A GREEN-HOUSE.

SEPTEMBER 29, 1887.

SIR: We submit a ground plan and section of greenhouse, with dimensions, and which we would be pleased to have your ideas upon, and instructions with regard to how to make a neat job, and one that will heat properly the space—say, when the weather is down to 20° below zero. It is in the city, and we want to make a neat job of it. We want you to render us advice as to location of stand-pipes or tanks, air-cocks if you advise any, or other stops if used; the best means to obtain a good circulation and proper heat with the least amount of 4-inch pipe; the best compound for rust joint, etc. The boiler is shown at B, with the two top outlets as shown. Now, will you draw in colored or lead pencil lines the runs and the number for the side and middle beds and returns (the return-outlets are on bottom of boiler, not shown), and mark sections of the pipes on the section plan? Boiler is located in the pit where stairs go down.

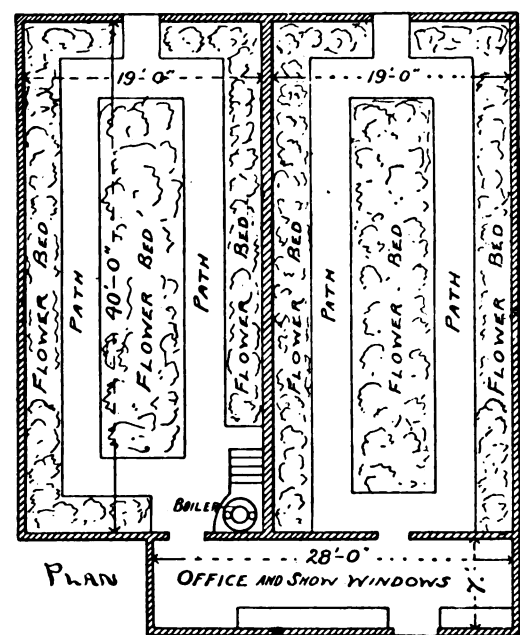
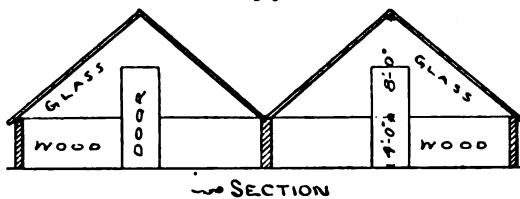
Mark location of stand-pipes or tanks, and return sketch as quickly as possible, for the work must be done as quickly as possible. The season is getting late; and give us the proper grade you would run the pipe.

Any pipes run near or on path at the office will be boxed with steps, but we do not want to cross the rear door with the pipes if it can be avoided. You can give sufficient instructions to work good results without any further statement from us.

Size of boiler used, 30x48 inches. Approximate heating power of 4-inch pipe, 1,250 feet. Heating surface, 4,082 square inches.

FITTER.

[The glass surface of your building is about 2,400 square feet. A good common rule to follow in so cold a climate, in determining heating surfaces for greenhouses or nurseries, is to allow one foot of 4-inch pipe to each two square feet of glass in a perpendicular form. This would call for 1,200 feet of 4-inch pipe.



In your case, however, the usual slanting roofs prevail, and in this case one foot of pipe to three of glass is considered enough. This would call for 800 feet of 4-inch pipe. It will be noticed in your plan that the total length of your outside "benches" or beds is about 200 feet. If you use four pipes the length of these beds, it takes about the length of pipe you require. You can, in your judgment, use all this pipe under the outer branches, or you can divide it and use some under the inner ones, though the latter we do not advise, as we consider it unnecessary.

From your plan we assume the boiler to be on the level of the floor. In such a case you will have to use your expansion-tank near the boiler, so you can place the doorways. Place the tank high up, and coils, which presumably you will for beds, take four separate flow-pipes to the

all doorways, etc. This may compel you to take the flow-pipes for the right-hand side out of doors. In such case use two flow-pipes from the boiler to two expansion-tanks, placing one in each house high up; then flow from the tanks to the coils. In returning you can carry the return-pipes with a little dip to get past the doorways. Let the pipes have a slight downward inclination and you will require no air-cocks.

We know nothing of the boiler you ask us about.]

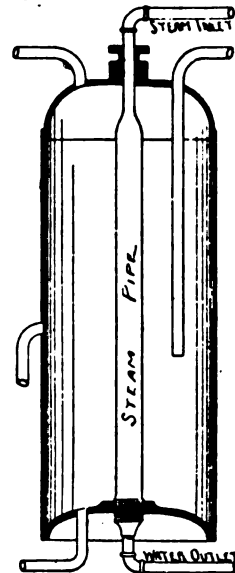
HEATING A DOMESTIC BOILER BY STEAM.

CORTLAND, N. Y., October 6, 1887.

SIR: Is there such a thing done as heating a thirty-five gallon galvanized-iron boiler by live steam, and would you be so kind as to inform me, and explain what you think about the matter?

CONSTANT READER.

[Mr. John Tucker, of the firm of Byrne & Tucker, New York, has devised several methods of applying steam to the warming of the water in an ordinary boiler, the sim-



plest of which is to run a steam-pipe through the boiler from top to bottom, using a stuffing-box on one end, so as to allow for the difference of expansion between the iron of the boiler and the pipe.

This is shown in principle in the illustration which we give. We are not aware of any merchantable apparatus for this purpose, but are of the opinion that the gentleman who first used it to our knowledge will not object to the use of it by any one who is desirous of making it.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kaiserbaker Gas-Light Company.	Equitable Gas-Light Company.
October 8.....	25.16	20.88	21.76	29.47	31.00	23.27	29.76

E. G. LOVE, Ph.D., Gas Examiner.

THE fifteenth annual meeting of the American Gas-Light Association was held in Dockstader's Hall, in this city, on Wednesday, Thursday, and Friday of this week. One hundred and fifty members were present, and twenty-eight new members elected. Papers were read on "Water-Gas," by Walton Clark; on "Illumination vs. Candle-Power," by Alexander C. Humphreys; on "The Relation of Intensity of Light and Visual Perception," by Edward C. Jones; on the "Utilization of Residual Products," by Charles H. Nettleton, and on "Fuel-Gas," by Emerson McMillen. Professor Henry Morton, President of the Stevens Institute, and an honorary member of the association, was present and took part in the discussions. The next annual meeting will be held in Toronto. The following officers were elected for the ensuing year:

President, Thomas Turner, Charleston, S. C. Vice-Presidents, A. B. Slater, Providence, R. I.; Emerson McMillen, Columbus, O.; J. P. Harbison, Hartford, Conn. Secretary and Treasurer, C. J. R. Humphreys, Lawrence, Mass. Finance Committee, C. H. Nettleton, Birmingham, Conn.; A. E. Boardman, Macon, Geo.; William H. Pearson, Toronto, Ont. Executive Committee, William Henry White, New York; G. G. Ramsdell, Vincennes, Ind.; H. B. Leach, Taunton, Mass.; D. G. Geggie, Quebec, Canada; T. G. Landsden, Washington, D. C.; F. S. Benson, Brooklyn, N. Y.

On Thursday evening a banquet was held at Lyric Hall, and on Friday an excursion was made around New York Bay and up the Hudson River.

FALL OF A RETORT-HOUSE ROOF.

LAST Sunday the roof of the retort-house of the Metropolitan Branch of the Consolidated Gas Company on Forty-second Street, between Tenth and Eleventh Avenues, in this city, fell in, injuring four men more or less seriously, though none, it is thought, fatally.

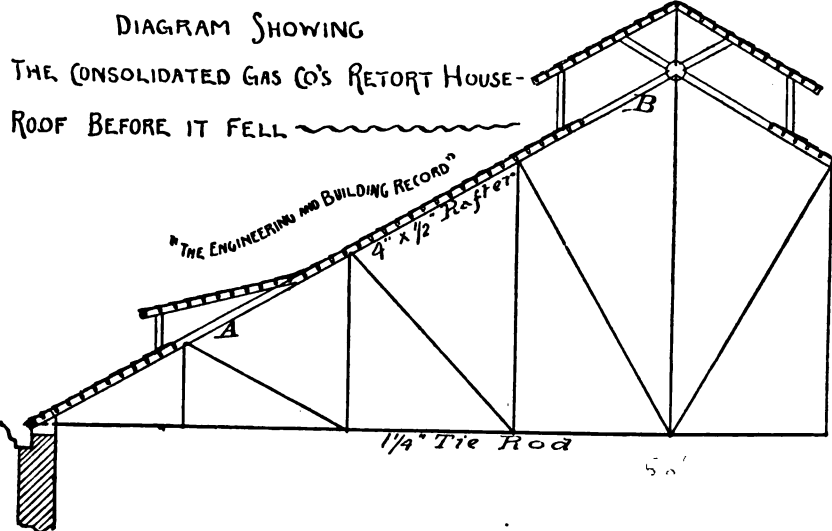
The building, a one-story structure of brick, 26x60 feet, and about 20 feet to the eaves, was erected in 1862.

The arrangement of the roof is shown in the accompanying illustration, which gives a little more than one-half of a truss.

The trusses were spaced 5 feet apart and were composed of $4 \times \frac{1}{2}$ -inch rafters and $1 \frac{1}{4}$ -inch tie-rods, the secondary struts and ties being all of round iron from $\frac{3}{8}$ to $1 \frac{1}{2}$ -inch diameter. The purlins were $1 \times \frac{3}{4}$ -inch and 9 inches apart. Purlins and rafters were each notched $\frac{1}{4}$ -inch at intersections, so as to bring their upper edges flush, and the covering of slate was wired directly to the purlins, which alone prevented the lateral deflection of the rafters.

For a distance of 4 feet 6 inches at A, and about an equal distance at B, there were no purlins and consequently no lateral support for the rafters.

The roof began to collapse at or near the east end, and the ruin spread at a very moderate speed for the whole length of the building, bringing down every truss, but giving most of the workmen time to escape. Nearly or quite all the rafters buckled at A on the south side, pulling the trusses in from the south wall and bringing the cast-iron gutters with them, but not otherwise materially injuring the walls, which were 16 inches thick, with 4-inch buttresses.



The retort-walls, which reached nearly to the tie-rods, prevented the trusses from falling very far.

Just what gave way first it is difficult to determine. A tie-rod, broken in a poor weld near where the collapse began, seemed at first the probable cause, but further investigation showed it more likely to have been the consequence of the disaster.

The fact that all the trusses that fell last buckled at A showed that to be the weakest point, and that each should have followed its neighbor so promptly shows that the margin of safety was exceeding small.

At A the rafter was in the condition of a column whose unsupported length exceeded 100 times its thickness, and its compressive strength was thereby reduced to one-fifth of what it would have been with proper lateral support. That it gave way is not so remarkable as that it should have waited twenty-five years before doing it.

Several fractures showed the iron to be stiff and brittle, though perhaps of fair tensile strength. Its stiffness saved it from an earlier fate. Had its ductility been up to modern requirements, it would probably have succumbed to the first snow-storm.

There was not much corrosion, and that very irregular. Several tie-rods had been reinforced on that account near the wall, but one, though reduced to nearly one-fourth of its original area, still held without assistance, giving additional support to the theory that the accident was due to the buckling of the rafters.

If the *Gas Engineer* is correctly informed, the Central Telegraph Department of the English Post-Office is to be fitted up with 50 Welsbach incandescent gas-lights.

REPORT OF THE HEALTH OF LIVERPOOL.

THE report, by Dr. J. Stopford Taylor, the Medical Officer of Health of Liverpool, for the year 1886, consists for the most part of tables of vital statistics. From these it appears that the improvement which has been going on for the last five years in the health of the city still continues.

The death-rate for the year was 23.7 per 1,000, the same as that for last year, and 2.9 per 1,000 less than the average rate for the last ten years.

The density of population in Liverpool is greater than in any other city or town in Great Britain, being in the proportion of 112.5 per acre, or a little over double the density of London—i. e., 55 per acre. It also has a large floating population, many of whom are dissipated and improvident, and its mortality must be always comparatively high.

Dr. Taylor thinks that if there is to be any further reduction in mortality from zymotic disease it is necessary that proper hospital accommodation be provided for the isolation of the earliest cases. It seems that heretofore this has been provided by the workhouse, but that this is no longer available.

The work of purchasing and destroying insanitary property continues, the number of houses demolished for this cause during the year being reported at 337. Fifty-seven tons of unwholesome meats and 50 tons of unwholesome fish were seized and destroyed.

The number of articles disinfected at the public disinfecting apparatus was, 28,270; including 2,175 beds; 2,987 mattresses, and 13,569 pieces of bedding. This will give an idea of the use that is made of this apparatus.

The report is accompanied by a map of Liverpool on which are noted the location of deaths from fever during the year, and, taken as a whole, gives a good idea of the great variety and magnitude of the sanitary work required in a sea-side port of nearly 600,000 inhabitants.

FROM the twentieth annual report of the Health Department of Cincinnati, for the year 1886, prepared by Dr. Byron Stanton, who was appointed Health Officer in September, 1886, we learn that the number of deaths during the year was 6,170, which, on an estimated population of 325,000, gives a death-rate of 18.98 per 1,000. The most prevalent epidemic disease was measles, of which 1,593 cases were reported, causing 145 deaths. Diphtheria is reported as having caused 195 deaths, besides 169 deaths reported as due to croup, many of which were, no doubt, diphtheritic. Typhoid fever caused 151 deaths, and 850 deaths are reported as due to consumption. The mortality from cancer is high, 124 deaths, giving 38.1 per 100,000 of population.

Dr. Stanton points out that the sewerage is insufficient and advises extension of the system and the making compulsory that house-connections be made with them, and reiterates the warning given in the reports of his predecessors as to the danger which exists from contamination of the water-supply of the city by the discharge of sewage into the river above the intake of the water-works.

The report of the Milk Inspector, Dr. T. Bange, shows that 2,127 samples of milk were tested, of which 54 were found below the standard. The standard adopted is that "Milk must not contain more than 87 per cent. of

water and not less than 13 per cent. of total milk solids and not less than 9.3 per cent. of solids, exclusive of fat."

The expenses of the department for the year were \$41,959.84.

FREDERIC W. VAUGHAN.

FREDERIC W. VAUGHAN, President of the Louisville Bridge and Iron Company, died suddenly at Louisville, Ky., on Wednesday, 19th inst. Mr. Vaughan was born at Warren, Knox County, Maine, on June 6, 1844, graduated at the Rensselaer Polytechnic Institute in the Class of 1863, and was elected a member of the American Society of Civil Engineers in 1869, of which he once served as a director. He went to Nashville during the war as assistant engineer on Government railways and has since been prominently identified with most of the bridge construction of the central South. He served as principal assistant to Mr. Albert Fink on the first bridge across the Ohio at Louisville, and has been closely connected with the Louisville Bridge and Iron Company ever since. In addition to the presidency of this company he held at the time of his death the positions of Chief Engineer of the Henderson Bridge Company and Consulting Engineer of the Louisville and Nashville Railroad system.

A man of warm social temperament and perfect integrity, he was an engineer of absolutely untiring energy and great executive ability. The enterprises with which he was connected and the people among whom he lived will suffer greatly by his death.

IN commenting on the first report of the Ohio State Board of Health we noted the wisdom of trying first to secure a complete registration of vital statistics, and second, the organization of local health authorities.

The State Board of Health of Maine, to judge from its second report for the year 1886, just issued, seems to think the matter of vital statistics hardly worth attending to, and has devoted its energies to the securing the passage of a law, which was approved last March, "to establish local boards of health and to protect the people of this State from contagious disease." This law contains twenty-eight sections and is very stringent in its provisions with relation to small-pox, diphtheria, scarlet fever, cholera, typhus, and typhoid fever, requiring householders and physicians to notify the local board of the existence of all such cases, and establishing a sort of quarantine on the infected premises. "No person having access to any person affected with any of the said diseases shall mingle with the general public until such sanitary precautions as may be prescribed by the local board or attending physician shall have been complied with." We suppose this last clause is intended to exempt the doctor from such precautions. The nurse is forbidden to leave the premises until she, or he, has a certificate of disinfection, etc., and the householder must not allow any property to be removed from his house without permission. We must confess that we do not think highly of this kind of legislation and do not believe that it will be enforced.

When the people of Maine adopt means for knowing promptly the localities in which people are dying too fast they can with profit begin preventive work, and until they have this knowledge it will only be the terror produced by a well-developed epidemic that will induce them to execute the law above referred to.

The second report is made by the Secretary of the Board, Dr. H. G. Young, of Augusta, and, with the appended documents, forms a volume of about 300 pages, which is mainly educational in character. It is to be hoped that under the new law the board may be able to make an original contribution to sanitary science by collecting data as to the hygienic condition of different parts of the State and presenting them in a well-digested report.

PERSONAL.

CAPTAIN W. T. ROSSELL, Corps of Engineers, has moved his office, temporarily, from Memphis to Sewanee, Tenn.

NAVAL CONSTRUCTOR JOHN B. HOOVER, U. S. N. has been ordered to duty relating to vessels to be built by Cramp & Sons.

SENATOR SENEOL, a prominent railroad man, died in Montreal, Can., October 11. He was interested in many railroads and navigation companies.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

PROPOSALS.

(Continued from page 576.)

Removing Wreck at Cornfield Shoal, Long Island Sound.

ENGINEER OFFICE, U. S. ARMY,
Room 57, Army Building, cor. Houston & Greene Sts.,
New York, October 24, 1887.

Sealed proposals, in triplicate, for removing the wreck of the schooner "Louise Bliss," now lying in about three fathoms of water near the west end of Cornfield Shoal, Long Island Sound, will be received at this office until twelve o'clock, noon, on Wednesday, November 23, 1887.

Further information, specifications and forms of proposals can be obtained at this office.

D. C. HOUSTON,
Lieut.-Col. of Engineers.

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WATER-PIPE.—Proposals will be received until the 4th day of November, to be endorsed "Proposals for Cast-Iron Water-Pipes, Boston Water-Works." 2,000 tons 6-inch pipe, class B; 550 tons 8-inch pipe, class B; 400 tons 12-inch pipe, class A; 1,000 tons 12-inch pipe, class B; 150 tons of special castings. Specifications may be obtained and plans seen at the office of the City Engineer, City Hall, Boston. William H. Smart, Chairman pro. tem. in Boston Water-Board, City Hall, Boston.



For works for which proposals are requested see also the "Proposal Column," pages 569-576.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE. ETC.

MINNEAPOLIS.—Bids for the machinery for the new pumping station will be received for forty days longer by the City Council. All bids so far received will be returned to bidders.

KENDALLVILLE, IND.—The contract has been let for the building of the water-works here. R. D. Wood & Co., of Philadelphia, have the contract for pipe and hydrants; the Knowles Steam-Pump Works for steam-pumps, and James Flower & Bro., valves.

KINSLEY, KAN.—Our correspondent writes: "Contract was let to D. Mitchell & Co., of Dodge City, Kan., and work will be begun immediately. The works will be the stand-pipe system, with compound pumps of 750,000 gallons capacity each. About four miles of main will be laid, works to be completed by January 10, 1888."

GREELEY, COL., October 12.—Our correspondent writes: "The subject of water-works is being agitated, but at present there are more theories than money to build any system. We have either to pipe water thirty miles, with 600 or 700 feet fall for that distance, or sink a caisson fifty or sixty feet, shutting off surface water completely, and drawing from a vein in the same rock, and use Holly or some other system of pumps. We have an elevation of 140 feet about one mile south of centre of the city, where a reservoir could be built for storage and service. That is the standing at present."

CHARLOTTE, N. C.—Mayor F. B. McDowell is dissatisfied with the service of the present water-company. He claims that it is inadequate and the works not what they should be. He says the citizens want a plant that can supply water for 11,000 people, about 140 hydrants, and that the city ought to own its plant, and would like estimates looking toward the building of such works. What rights the present company have to supply water to the town are not stated.

PROPOSALS will be received, until October 24, by City Clerk G. H. Cole, of Toledo, O., for boring artesian wells; also for paving Indiana Avenue.

ORANGEBURG, S. C.—Our correspondent writes: "The city has made arrangements by which a 6-inch pipe will be laid in our town—say about 12 or 14 miles—during the next year or two."

GALT, ONTARIO, CAN.—Our correspondent writes: "We have had the ground surveyed, plan of the streets with location of hydrants made, and our system of water-works completed—viz., to obtain water from Spring Lake, situate three miles from corporation, and pump it into reservoir 210 feet above the city level. The committee have submitted the scheme to the Council, by whom it has been approved. A by-law has been introduced and read a first time and after it receives its second reading will be submitted to a vote of the ratepayers, after which, if the vote be favorable, the work will proceed."

SOUTHBIDGE, MASS.—Our correspondent writes: "The water-works are already established three years. The only change which I know of at present is the enlarging of capacity, which will probably be commenced at a future date."

EAST JORDAN, MICH.—Our correspondent writes: "If talk would build water-works we should have had them ere this, but no official steps have been taken as yet to establish water-works in this place."

RICHFIELD, KAN.—Our correspondent writes: "Nothing has been done toward water-works here as yet, and nothing is contemplated for the present further than the sinking of an artesian well. What that may bring about no one knows. Our town is too young to consider the question of water-works as yet."

ORTONVILLE, MINN.—Our correspondent writes: "Have had our election; result was in favor of bonds; are negotiating same, and expect to complete same this fall."

ESSEX, VT.—Our correspondent writes: "In reply will say that this town has taken no steps whatever in regard to establishing water-works of any kind whatever, and there are none in contemplation to my knowledge."

GREENVILLE, O.—Our correspondent writes: "No election was held; parties withdrew their proposition to build."

WESTFIELD, N. Y.—Our correspondent writes: "Last Saturday, October 15, the voters of the corporation voted to raise \$50,000 for water-works. Further than this I cannot tell what will be done."

GREENVILLE, MICH.—Our correspondent writes: "The electors of the city voted in favor of a loan for water-works on the 10th inst., and the city will put in said works as soon as practicable."

JERSEY CITY, N. J., will advertise for proposals for a supply of pure and fresh water to the city. Address the Board of Works.

CINCINNATI, O.—Special Committee of Council have for consideration a resolution providing for a commission of five on purity of the water-supply.

MODESTO, CAL.—The Turlock Irrigation District voted October 8 on issuing \$600,000 to build a canal. The proposition was carried.

SACRAMENTO, CAL.—The City Engineer has been directed to prepare plans and specifications for a number of pipe and brick sewers.

JERSEY CITY, N. J.—The Jersey City Board of Finance on October 13 refused to approve the Board of Works resolution providing for a contract with the Bartlett Water Company for a water-supply for the city at a cost of \$36.50 per million gallons. It directed that advertisements be inserted inviting proposals for a water-supply.

GENEVA, N. Y.—Citizens are talking of building a main sewer.

SANTA FE, N. M.—Articles of incorporation of an irrigating enterprise in the Central Rio Grande Valley were filed at the office of the Territorial Secretary October 11. The incorporation is to be known as the Albuquerque Land and Water Company. Mr. Gay Robertson, of Kansas City, has been earnestly promoting it for the past year. The enterprise contemplates the irrigation of 1,500,000 acres of the fruit and farming lands in the Central Rio Grande Valley. The water-supply is to come from the Rio Grande. The main canal, according to the survey already completed, will be 150 miles in length.

JERSEY CITY, N. J.—This city and West Hoboken have united in requesting the City Engineer of Jersey City to prepare plans and estimates for a joint sewer along Paterson Avenue.

COLUMBUS, O.—\$8,000 is to be expended on a main sewer in District No. 1.

BUNKER HILL, ILL.—The erection of water-works in this city is being generally discussed. The question will doubtless be early submitted to a popular vote.

STAUNTON, ILL.—Staunton wants a system of water-works, and the Village Board has completed two surveys for reservoirs, one of which, it is estimated, will contain 100,000,000 gallons of water. The building of the dam will cost about \$11,000. No active operations will be commenced this season, however.

OCEAN SPRAY, MASS.—Ocean Spray, Great Head, and Winthrop have held a town meeting on sewerage. The expression of those present was unanimous in its favor.

LOUISVILLE, KY.—The Louisville Water Company has elected directors and officers as follows: Charles R. Long, President; James G. Gilbert, W. W. Smith, J. W. Story, T. L. Burnett, and Leander Reed, Directors; W. P. McDowell, Treasurer; J. B. Collins, Secretary; Charles Hermans, Superintendent and Chief Engineer.

CHILLICOTHE, MO.—An official test of the Chillicothe Water-Works was made October 11. The water is brought from Grand River, two miles distant.

WEST RANDOLPH, VT.—West Randolph is being supplied with water from the new works as fast as the connections with the mains can be made. The cost of the works was \$20,000.

LANCASTER, PA.—The Mayor will receive proposals until October 28 for four steam-boilers, 100 horse-power, of steel, Jarvis settings, for the water-works.

BEVERLY, MASS.—A special town meeting was held October 18 to see what action the town will take to lower the level of Round Pound, in accordance with the petition of the Board of Health, which has declared it a nuisance. Also to see if the town will take any action regarding drainage below Brimball Avenue, between Cabot Street and Kitteredge crossing. An electric-light is also called for.

BAKERSFIELD, CAL.—The Supervisors, October 10, granted a franchise for a water company.

PROVIDENCE, R. I.—Common Council has authorized the Mayor to borrow \$180,000 for purchase of lands for sewage-pumping works.

PASSAIC CITY, N. J.—The Acquackanuk Water Company, which supplies Passaic with water, has passed into the control of Garrett A. Hobart, of Paterson, and John R. Bartlett and others, of the West Milford Water Storage Company. They will supply Passaic with water from other sources.

BOSTON, MASS.—See our Proposals for tenders for water-pipe.

MONTREAL, CAN.—The city will issue proposals for about \$50,000 worth of iron and brass pipe and piping for the water service. Address Mr. Lesage, at the water-works.

CLAYTON, N. Y.—Water-works are to be constructed here. Address the Town Clerk. Immediate attention is necessary.

HOLDRIDGE, NEB.—Address Nels. Nelson about water-works here.

CEDAR FALLS, MICH.—City Council has ordered specifications prepared for water-works. Address the City Clerk.

SAN BERNARDINO, CAL.—The Mountain Water Company has been incorporated; capital stock, \$100,000.

BEVERLY, MASS.—The town has accepted the new water-works. They cost \$139,000. The superintendent is Mr. Pickett.

BATH, N. Y.—The new water-works, built by Bassett Bros., of Buffalo, were tested September 20 and accepted. The engineer is William E. Howell.

MOUNT CARMEL, ILL.—The Mount Carmel Development Company has been incorporated by Robert Bell and others, to construct a canal to supply water.

WARE, MASS.—The new system of sewerage is now being surveyed.

WESTBORO, MASS.—Our correspondent writes: "Our water-works were established in 1878, and have been in successful operation since. The town voted this season to improve the reservoir, and have expended about \$10,000 so far. It is estimated that the improvements will cost \$5,000 or \$6,000 more."

GREENVILLE, MICH., voted, October 10, to have water-works; estimated cost, \$25,000.

SPRINGFIELD, ILL.—This city, previously noted, has appointed a committee of five to confer with the Water Commissioners on propositions already submitted for increasing the water-supply.

RAHWAY, N. J.—The Pennsylvania Railroad will have its own water-supply, laying mains to the Rahway River and pumping into tanks at Scott Avenue.

ST. JOHNSLAND, L. I.—The Board of Commissioners of Charities and Corrections has sent to the Supervisors of Kings County plans and specifications for water-supply, including pumping-engines, sewers, and roads; estimated cost, \$360,000. William H. Ray, of Brooklyn, is President of the Board of Commissioners.

TORONTO, CAN.—William Hamilton, Superintendent of Water-Works, reports that "a plan for the enlargement of these works has not been decided upon. I have recommended a 4-foot cast-iron flexible-joint pipe, with an 8-million pumping-engine. The pipe will be about 10,000 feet long."

GAS AND ELECTRIC-LIGHTING.

AUGUSTA, GEO.—The Augusta Gas-Light Company are extending their plant.

COLUMBUS, GEO.—A permit to erect an electric-light and power plant in this city has been applied for by Messrs. T. E. Blanchard, Amory Dexter, and E. H. Jenkins.

McKEESPORT, PA.—The Electric-Light Company has enlarged its electric-light plant from 3,000 to 4,000 lights.

PORTLAND, ME.—Petitions from the Consolidated Electric-Light Company and the Portland Light and Power Company to furnish electric-lights are before City Council.

PORTLAND, ME.—Electric lights will be placed on Portland Bridge.

GARRETTSVILLE, O.—C. M. Udal contracts to maintain electric street lights for \$450 per annum.

CHICAGO.—Address Professor Barrett, City Electrician, in regard to electric-light system for the streets. The city has a committee to obtain cost of plants. Immediate attention is necessary.

ST. CLOUD, MINN.—The Electric-Light Company will have a 450-light tower ready for use within 30 days.

SEWARD, NEB.—The city will have electric lights in the streets.

TROY, N. Y.—The Union Railroad Company has contracted with the Edison Electric-Light Company to light and heat the union depot. The cost of the plant is estimated at about \$30,000. The Edison incandescent system will be used.

PEORIA, ILL.—Incorporated is the Peoria Heat, Light, and Power Company, of Peoria, Ill.; furnish heat by steam and light by electricity. Incorporators: Joseph B. Smith, Eliot Callender, S. H. Thompson, R. S. McDonald.

ROCKVILLE, CONN.—The gas company is negotiating for the introduction of the Sawyer-Mann electric-light.

CLEVELAND, OHIO.—The Bellevue, Ky., Natural-Gas Company is asking for permission to establish a gas-plant and lay mains.

UTICA, N. Y., is advertising for gas and electric street-lights. Until October 28. Address the City Clerk.

ORANGE, N. J.—The Edison Illuminating Company, which was recently incorporated for the purpose of establishing an electric light, heat, and power plant in the Oranges, organized October 11 as follows: President, Gilbert R. Hayes; Vice-President, Thomas A. Edison; Secretary, Eugene S. Kass; Treasurer, George Spottiswoode.

MEXICO, N. Y.—Articles of incorporation of the Mexico Electric Light and Power Company have been filed to furnish heat to manufacture electric-light, both arc and incandescent. The capital stock is \$8,000, and the trustees are William H. Weed, Edwin L. Huntington, and S. L. Alexander.

PATERSON, N. J.—The Paterson Electric-Light Company will establish the incandescent-light system, and supply houses and business places all over the city.

PHILADELPHIA.—The Royal Gas Company, of Philadelphia, has been merged with the Washington Gas Company. The capital of the new concern is \$1,700,000, and the new company will be known as the Royal Gas Company. The President is William P. Logan.

BALTIMORE, CONN.—gas-works were destroyed by fire October 14. They will be rebuilt.

JAMAICA, L. I.—The Village Trustees have awarded the contract for street-lighting to the Jamaica Gas-Light Company.

ST. LOUIS, MICH.—will have electric street-lighting.

LOUISVILLE, KY.—There is a movement in Councils that the city buy the works and franchise of the Louisville Gas Company. Address L. N. Demlitz, office of City Attorney.

PHILADELPHIA.—The sole transfer of the franchises and property of the Balducci Natural-Gas Company to a company of Philadelphia capitalists, represented by a New York broker, is announced.

MCDONALD, PA.—A natural-gas plant will be developed here and works built for Edney Coal Mining Machine Company.

BAKERSFIELD, CAL.—A franchise for an electric-light company has been granted.

GREAT BARRINGTON, MASS.—A meeting was held Thursday evening to take action regarding the formation of a stock company for supplying the town with light. P. A. Russell, the President of the Berkshire Woolen Company, has prepared the following estimate: Number of lights now in use, 240; probable increase, 70; total yearly receipts, \$4,000; total expense, \$2,330. A dynamo and moving would cost from \$6,000 to \$6,500.

ST. CLOUD, MINN.—An electric-light plant for street-lighting will be established here.

FLORENCE, ALA.—will have electric street lights. The plant will be completed by December 15.

CHEYENNE, WYO.—The Standard Gas Company, capital \$100,000, has been incorporated in Cheyenne. One of the incorporators is Bob Ingersoll, of New York.

BUFFALO, WYO.—will have electric-lamps for street-lighting.

HOOSICK FALLS, N. Y.—has contracted with Hon. S. D. Locke to light the streets with electric-lamps.

EAST ORANGE, N. J.—Articles of incorporation of the Columbia Light and Power Company have been recorded. The object of the company is to furnish electricity for lighting, heating, and power. The principal place of business is East Orange.

GRASS VALLEY, CAL.—On October 13, the question of lighting the streets with gas or with electricity was before the Town Trustees. A committee has gone to Nevada City to study the electric-lights there.

ST. ALBANS, VT.—An electric-light plant will be erected here.

ROANOKE CITY, VA.—Abstract of bids for erecting an electric-light plant, opened October 10: American Electric-Light Company, Nashville, Tenn., \$18,550; Thomson-Houston Electric-Light Company, Boston, Mass., \$22,125; Cecil P. Poole, Lynchburg, Va., \$26,200.

UTICA, N. Y.—City Council is asking for bids on street lighting. Address the City Clerk. Immediate attention is necessary.

ASHANAY, R. I.—Money has been raised to light the streets.

WESTON, W. VA.—will erect an electric-light plant.

SPOKANE FALLS, WYO.—wants proposals for erecting an electric-light plant (1,800 incandescent and some arc lights). Immediate attention is necessary.

MEMPHIS, TENN.—The Equitable Gas-Light Company has been incorporated, with capital of \$750,000 cash, paid up. They have purchased location for their works, and will build works. W. H. Katzenberger is President, P. G. Goodhart is Vice-President.

DAYTON, TENN.—W. G. Allen and others will erect an electric-light plant.

ANNISTON, ALA.—Address the Anniston City Land Company in regard to establishing an electric-light plant here.

MINNEAPOLIS.—The Court-House Commission has awarded contract for electric-lighting the new court-house and city hall to the Edison Electric Light and Power Co. at \$3,000 per year. Other bids were: United States Electric-Light Co., two bids, one \$3,600, one \$3,400; the Thomson-Houston Electric-Light Co., \$4,988.

GRAND FORKS, DAK.—New gas-works are building here.

PITTSBURG, PA.—A company has been formed to supply the district on the South Side hilltops with incandescent lights.

EDWARDSVILLE, ILL.—The City Council has contracted with E. W. Mudge, of this city, to light the streets with 2,000 candle power electric-lights, the franchise to continue five years. Fourteen lights were located by the Council, to be furnished at an annual rental of \$108 each, and all additional lights to be supplied at \$100 each.

TRINIDAD, COL.—The Trinidad Electric-Light Co., capital stock \$25,000.

SPRINGFIELD, ILL.—Niagara Light and Fuel Company, at Chicago; capital stock, \$1,000,000; incorporators, Edgar L. Hance, Alfred E. Barr, and Samuel Kerr.

STEAM-HEATING, BUILDINGS, ETC.

SACRAMENTO, CAL.—Lawson & Co. were awarded a contract to supply jute machinery for \$106,851.55, for the prison.

TORONTO, CAN.—Architect Lennox has prepared plans for the court-house and city hall. The plans have been referred to Mr. Matthew Sheard, to report upon them.

NEWARK, N. J.—The Boston Super-Heated Water Company has an application before City Council for a permit to lay mains and supply heat to buildings.

WARREN, O.—The steam-heating contract for the new Park Hotel has been awarded to Schell, Sample & Co., the lowest bidders.

OMAHA, NEB.—All bids for constructing the City Hall have been rejected and new proposals advertised. Address the Board of Public Works.

AUGUSTA, GEO.—Address A. H. Davidson, City Engineer, with proposals for building a warehouse and wharf.

CROMWELL, CONN.—has voted to build a Town Hall.

NEW YORK CITY.—The Board of Education has made a requisition on the Comptroller to issue \$600,000 of bonds at once for new school houses.

BRIDGES.

ROME, GEO.—See our Proposals for a reference to a bridge over the Oostonaula River.

ELIZABETH, PA.—Our correspondent writes: "Company organized and officers elected for Elizabeth Bridge Company; \$40,000 stock subscribed. The company mean business. The bridge will be built over the Monongahela River at this place. President Bridge Company, W. W. O'Neil; Secretary, P. T. B. Shaffer; Treasurer, William D. O'Neil."

MECHANICSVILLE, N. Y.—Our correspondent writes that "the bridge company has organized with the following officers: W. W. Smith, President; J. F. Terry, Secretary, and has made a preliminary survey of the river for a site, but has not yet decided where to locate it."

HARRISBURG, PA.—Our correspondent writes in reference to bridges: "The Pennsylvania Railroad Company has presented plans and propositions to erect overhead bridges in our city over Mulberry, Race, and Dock Streets, which were considered in Com-

mon Council and referred to the Committee on Highways, which Committee have not yet reported on the same."

NORTHAMPTON, MASS.—Our correspondent writes: "No action has yet been taken, but the matter of constructing a bridge over N. H. & N. Co.'s road and Mill River, to take place of covered wooden bridge, and South Street grade crossing, will be considered as soon as the N. H. & N. Co. present their plans and recommendations."

SALEM, MASS.—The Boston and Maine Railroad has a new drawbridge over the Mystic River, built by Joseph Ross, of Ipswich.

OHIO BRIDGES.—The Bellaire, Zanesville and Cincinnati Railroad Company, Ohio, is building ten new bridges.

FORTRESS MONROE.—The Groton, N. Y., Bridge Company has secured the contract for building the pier here. Over 500 tons of iron castings are called for in the estimate.

GREEN BAY, WIS.—It is proposed to build a drawbridge on line of Walnut Street, to cost \$10,000, and repair Mason Street bridge at considerable expense.

BRIDGE.—Detailed estimates for a bridge over the English Channel have recently been laid before the French Minister of Public Works by Vice-Admiral Cloué, of the French Navy, in the hope of obtaining a Government subvention for the project. The cost of the bridge is estimated at \$22,000,000.

NEWARK, N. J.—Committees of citizens of the Eighth Ward and the township of Kearney advocate the construction of a free bridge across the Passaic to connect Kearney with Newark. The Board of Freeholders appointed a committee of five to confer with a similar committee of the Hudson County freeholders on the subject.

LAREDO, TEX.—City Council has decided to grant a franchise to the Ornelas Bridge Company to build a street-railway bridge across the Rio Grande, on condition that the city receive \$5,000 per annum for twenty-five years. The bridge company is given thirty days in which to accept or reject the proposition.

TRENTON, N. J.—In regard to prospects of a new bridge over the Delaware River, our correspondent writes: "None whatever; we have two, one used by the Pennsylvania Railroad Co., and the other a private company stock corporation."

POTTSVILLE, SCHUYLKILL CO., PA.—The following bids for building an iron bridge in Tremont Borough, Pa., were received by the County Commissioners, October 11:

Tippett & Wood, Phillipsburg, N. J., \$735.
John W. Berry, Pittston, Pa., \$410.
Penn Bridge Co., Beaver Falls, Pa., \$765.
King Iron Bridge and M'f'g Co., Cleveland, O., \$768.
Nelson & Buchanan, Chambersburg, Pa., \$774.
Morse Bridge Co., Youngstown, O., \$825.
Wrought Iron Bridge Co., F. W. Finly, Carlisle, Pa., \$723.
Berlin Iron Bridge Co., Binghamton, N. Y., \$795.
Contract was awarded to Penn. Bridge Co., October 17.

BRIDGE.—See our Proposals for reference to a bridge over the Maumee River, O.

DULUTH, MINN.—A project is started to bridge the canal.

FORT SCOTT, KAN.—The Kansas City Bridge Company has the contract for a bridge over Mill Creek. Address F. L. Underwood.

PASO ROBLES, CAL.—Blackburn Bros. & James will build a bridge over the Salinas River.

CLEVELAND, O.—Plans for a bridge on Fairmount Avenue, over Nickel-Plate Railroad, are nearly ready. Address City Engineer Rice.

ROME, N. Y.—Bids for constructing an iron bridge across Wood's Creek, near Patrick's, were recently opened by the Commissioners of Rome and Verona, as follows: Groton Iron Bridge Company, \$1,640; Smith Company, \$1,675; Smith Company (second bid), \$1,750; Berlin Company, \$1,610; King Company, \$1,624; Morse Company, \$1,595; Penn Company, \$1,600; Wrought Iron Bridge Company, of Canton, O., \$1,550. The contract was let to the last-named company, their bid being the lowest.

JACKSONPORT, ARK.—Address the County Court in regard to bridges to be built over the Cache and the White Rivers.

STREET WORK AND PAVING.

LITTLE ROCK, ARK.—Bids are called for up till October 25, for 11 blocks of Telford macadam pavement by the Commissioners of Pavement District No. 2: Sidewalk District No. 3 will put down about 1½ miles of sidewalk and curbing on East Fifth Street; Sidewalk District No. 5 has been organized for the purpose of building sidewalks and laying curb on Cumberland Street, about 1½ miles. For information address the City Engineer.

NEW YORK CITY.—The Board of Estimate and Apportionment has appropriated \$250,000 for the improvement of Morningside Park.

DULUTH, MINN.—Improvements on 12th and Michigan Streets are ordered.

PITTSBURG, PA.—Address E. M. Bigelow, City Engineer, on street and sewer work ordered by Council.

CAMBRIDGE, MASS.—The extension of Windsor Street is under consideration; estimate, \$7,000.

PROVIDENCE, R. I.—Much grading and granite paving was ordered by the Common Council at the meeting October 17. Address the Clerk of Council.

PROVIDENCE, R. I.—Council has passed an order for the improvement of Brown Street; cost \$9,340.

ROCHESTER, N. Y.—City Council has ordered Kirk Street extended to Union Street.

ROCHESTER, N. Y.—Address the City Clerk in regard to street work and extension.

NEWARK, N. J.—Address the Mayor in regard to much street work which is now ordered to be done.

ST. PAUL.—The order for grading Winslow Avenue at an estimated expense of \$18,713 was favorably reported to the Board of Public Works.

MILWAUKEE.—Plans are being prepared for the new public park in the Eighth Ward. There will be an artificial lake and a rustic bridge over it.

OMAHA, NEB.—The Board of Public Works has let the contracts for grading part of Jones Street to Fitch & Co. at 17½c. per cubic yard; Howard Street to G. W. McKinney at 20c. per cubic yard; Seventeenth Avenue to Fitch & Co. at 19c. per cubic yard; Grace Street to G. W. McKinney at 16c. per cubic yard.

ST. PAUL, MINN.—Our correspondent writes: "The public work done in this city during 1887 has been unprecedented. It may be summarized as follows: Miles of street grading, 69; miles of paving, 11; miles of sewers, 15; miles of wooden sidewalk, 55. In addition to the wooden sidewalks a large amount of artificial stone walk has been laid, three firms in St. Paul who manufacture it having been crowded all the season. The cost of the work has been approximated as follows: Paving, \$422,115; sewers, \$289,136; grading, \$988,375; bridges, \$200,000; total, \$1,902,627."

TARRYTOWN, N. Y.—It is stated that \$20,000 will be expended for street improvements. Address the Village Clerk.

RAILROADS, CANALS, ETC.

ALLEGAN, MICH.—Over \$30,000—half the amount—to begin the construction of the C. J. & M. R. R. has been subscribed, and work will likely begin late in the fall.

ALBANY, N. Y.—The Caldwell and Bolton Turnpike Road Company has been organized with the following officers: President, George H. Cramer, Troy; Vice-President, W. Sherman, Glens Falls; Secretary, Robert Imrie, Caldwell. The object is to build a boulevard along the shore of Lake George from Bolton to Caldwell.

CHICAGO.—Incorporated is the National Gas Car Heating and Lighting Company at Chicago. Incorporators, Harry W. Holmes, Lewis K. Curlett, and William S. Brewster.

RAILROAD.—The contract for building a railroad into the San Jacinto Valley by the California Central Railroad Company has been signed. J. A. Green, James Kerr, and H. C. Ashenfelter signed for the people of San Jacinto, and F. T. Perris for the California Central.

DULUTH.—Shepherd & Winston, contractors, of Minneapolis, have secured contract for the 30-mile extension of the Duluth and Iron Range Railroad. Construction is to be completed by April next.

HAMMOND, ILL.—A charter has been granted to a street railway company here.

MINNEAPOLIS.—To Henry & Balch, of Minneapolis, the Milwaukee, L. S., and Western R. R. Co. awarded contract October 10 to grade 40 miles of road-bed from Rhinelander, northwest through the woods. The same company have let the contract for grading an extension of 6½ miles from Hurley south-west to the farm of Henry & Balch.

HARRISBURG, PA.—A charter has been issued to the Squirrel Hill Railroad Company of Allegheny County.

FRANKLIN, MASS., October 11.—A party of men are surveying a route for the New York and Boston Rapid Transit Company through South Wrentham.

LOS ANGELES, CAL.—The Santa Monica Outlook Railroad Company has been organized. The officers elected for the following year are: Abbot Kinney, President; Patrick Robertson, of Scotland, Vice-President, and James Bettner, of Riverside, Secretary and Treasurer.

SALIDA, COL.—Land-Agent Hastings has received the right of way for an extension of the Denver and Rio Grande from Poncha Hot Springs through the San Luis Valley. The road will be extended to Seguche and Del Norte.

NEVADA COUNTY, CAL.—It is proposed to form a joint stock company and sink a well 2,000 feet if necessary. A capital of \$2,500 will be subscribed.

The Board of Supervisors of Nevada County have received a petition from the Nevada County Land Association, asking to be granted a franchise to construct an electric railway from Nevada City four miles along the county road.

KNOXVILLE, TENN.—The survey of the Belt Road has been completed and the engineers are now making the profiles. These profiles and estimates will be completed in a few days, when it is understood the entire line will be let to contract.

SIoux CITY, IA.—Address John Peirce, of Peirce's Addition, about a \$90,000 contract for grading, etc., for a cable railway.

ROCK ISLAND, ILL.—Incorporated is the Elm Street Railway Company, at Rock Island; incorporators William McEniry, John J. Reimers, W. P. Quayle, Will R. Johnson, and Will J. Whitehead.

MERIDIAN, MISS.—Dunn Bros., the contractors to build the Warrior Coal Field Railroad from Meridian to Gainesville, Ala., broke dirt on this end October 15, just inside of the city limits. They are under contract to prepare the bed for the rails within six months.

BAKERSFIELD, CAL., has granted a franchise for a street railway.

ELIZABETH, N. J.—On October 24 Council will give a hearing to all parties interested in electric-motor street railways. A report will be discussed, from committee, favoring the granting of a franchise to the Union Electric Railway Company.

EAST SAGINAW, MICH.—The Toledo, Saginaw and Mackinaw Railroad Company has let the contract very recently for the construction of the road between East Saginaw and Durand, a distance of forty-five miles, to McRae, Lally & Son, of Detroit. The contract calls for the completion of the road by July 1, 1888.

NEW YORK CITY.—The Arcade Railway directors for the following year are: Ex-Judge Charles P. Daly, Melville C. Smith, George S. Coe, Jerome Fassler, Alfred M. Hoyt, Cornelius J. Ryan, William Windom, Benjamin F. Dunning, Arthur B. Claflin, George W. Lyon, Henry Sanford, Ex-Senator Edward B. Thomas, and James F. Pierce. It is claimed contracts will be let in thirty days.

CHICAGO.—Incorporated is the Chicago Transfer Railroad Company. Capital stock, \$2,000,000. It is proposed to construct a railway from a point in the Town of Proviso, Cook County, Ill., to an intersection with the Chicago, Rock Island and Pacific Railway in the Town of Orland, Cook County, Ill. Incorporators, Ansen Oppenheimer and others.

ST. PAUL.—Ramsey and Hennepin County Commissioners have let contract for Marshall Avenue and Lake Street bridge as follows:

For the substructure, to P. P. O'Halloran, to use Kettle River stone, \$33,136.96; for the superstructure, to the Canton Wrought-Iron Bridge Company, of Canton, O., for \$109,100.

BIDS OPENED.

LAKE, ILL.—Bids for furnishing pumping-engines were opened by the Board of Trustees October 4, as follows:

Holly Manufacturing Company, Lockport, N. Y.: At 68th Street station, 1 No. 8 pumping-engine (4 boilers), 12,000,000 daily, duty 95,000,000 at ¾-capacity and 105,000,000 at full capacity, \$58,500, including boiler foundations and settings, but not engine foundations. At 59th Street station, 16,000,000 gallons daily, No. 9 pumping-engine (6 boilers), duty 95,000,000 at ¾-capacity and 105,000,000 at full capacity, \$89,400, including boiler foundations and settings, but not engine foundations; or a No. 8 engine, duty 95,000,000 at ¾-capacity, or 105,000,000 at full capacity, \$58,500, including boiler foundations and settings, but not engine foundations. If two 12,000,000-gallon pumping-engines are selected, with 6 boilers, deduct \$2,000 for boilers omitted.

Henry R. Worthington: At the 68th Street station, 12,000,000 gallons, 2 engines, 6,000,000 each, including foundation, \$51,100, 7 boilers, including foundation, \$17,200, total, \$68,300; 2 engines, 6,000,000 each, exclusive of foundation, \$48,500, 7 boilers, exclusive of foundation, \$16,100, total, \$64,600; guaranteed duty, 100 million. At the 59th Street station, 16,000,000 pump, 2 engines, 8,000,000 each; 2 engines, 8,000,000 each, including foundation, \$58,000, 10 boilers, including foundation, \$23,850, total, \$81,850; 2 engines, 8,000,000 each, exclusive of foundation, \$55,500, 10 boilers, exclusive of foundation, \$22,600, total, \$78,100; guaranteed duty, 100 million. At the 59th Street station, 12,000,000 pump, 2 engines, 6,000,000 each, including foundation, \$50,500, 8 boilers, including foundation, \$19,200, total, \$69,700; 2 engines, 6,000,000 each, exclusive of foundation, \$48,500, 8 boilers, exclusive of foundation, \$18,200, total, \$66,700; guaranteed duty, 100 million.

SAN FRANCISCO, CAL.—The following bids for building a pier 534x100 feet in 20 to 35 feet of water, and a freight-shed 520x90 feet, were received by Board of Harbor Commissioners, October 7:

George W. Davis, San Francisco, informal. R. W. McCann, San Francisco, \$37,980.23; check informal.

American Bridge and Building Co., San Francisco, \$38,943.

James G. McMahon, San Francisco, \$39,850.

San Francisco Bridge Co., \$40,937.

R. McKilliken, \$41,400.

All bids were rejected; proposals will be re-advertised. Marsden Manson is Chief Engineer.

LANCASTER, PA.—The Special Committee of City Councils on Water-Works, Sewerage and Drainage opened the bids for the water-works October 13 as follows:

John A. Burger proposed to erect the buildings for \$28,387, with granite base for engine and boiler house and stack; or, for \$27,247, if the bases be of brick.

R. A. Malone and Thomas C. Wiley, the work in full, for \$29,750.

Amos S. Urban, the work according to plans and specifications, for \$24,450.

John Evans & Son, to build complete the water-works for \$24,900.

The following bids were informal and were not considered:

George Ernst, Jr., bid \$24,550.28.

McLaughlin & Gesell bid \$35,000.

I. P. Mayer bid \$23,800.

The contract was awarded to Amos S. Urban for \$24,450. Mayor Morton was authorized by the committee to sign the contract on behalf of the city. The work must be finished by February 1, failing in which \$15 per day for all time over that date will be forfeited.

The Warren Foundry & Machine Company accepts the award for furnishing the more than 5,000 feet of pipes required for the main leading from the water-works to the reservoir.

PENSACOLA, FLA.—At a meeting of the City Commissioners October 11 bids for the erection of a public building were opened as follows:

B. R. Pitt, \$33,000; R. H. Turner, \$37,590; A. V. Clubbs, \$24,000.

LINCOLN, NEB.—The following bids for water-works, Pawnee City, Neb., and Long Pine, Neb., have been received by A. A. Richardson, C. E., of Lincoln:

Charles Schroeder, Columbus, Neb., total work without wells, \$25,125 for Pawnee City.

H. F. Cook & Son, Omaha, Neb., with wells, \$2,500 for Pawnee City.

S. K. Felton, Omaha, Neb., total work for Long Pine, Neb., \$7,000.

CINCINNATI, O.—Bids on supplies for public building have been opened by the Committee as follows: Plumbing—Thomas J. O'Hara, \$929; The Gibson Co., \$895; J. G. Murdock & Co., \$825; Murphy & Atkinson, \$962; George Eichert, \$898. Awarded to Murdock, seven voting for Murdock, one for Eichert, and one for Gibson.

Carpets—Shillito & Co., Alms & Doepeke. Awarded to Shillito & Co.

Frescoing—Pedretti, three bids, according to quality of work, \$720, \$600, and \$500. Fehrenbruck & Engel, two bids, \$400, \$450. Pedretti's bid included painting, graining, etc., of woodwork. The award was made to them at \$450.

Chairs to the Robert Mitchell Company, "Delawares," at \$1.75 each.

PHILADELPHIA.—Bids were opened at the Board of Education for the following work: Additions to heating Lynd School House, 20th Section, A. H. Lanning, \$140; M. McManus, \$120. The latter was awarded contract.

For heating and ventilating new school-house, Adams and Lafayette Streets, 22d Section, the bids were: A. H. Lanning, \$805; J. Bartlett's Sons, \$1,050; M. McManus, \$945. Lanning received contract.

For heating and ventilating Morris City School the bids were: A. H. Lanning, \$560; J. Bartlett's Sons, \$650; McManus, \$615. Lanning was awarded the work.

NEW YORK CITY.—Bids were opened at the Department of Docks on October 14 for preparing for and building a new wooden pier near the foot of Charlton Street, North River, to be known as Pier, New 37, North River. The following were the bidders: Pacific Improvement Co., \$59,500; William P. Kelly, \$72,000; T. & A. Walsh, \$67,000; J. Eugene Wright, \$71,000; P. Sanford Ross, \$64,490; John Gillies, \$63,000.

NEW YORK CITY.—Bids were opened at the Department of Public Works, October 20, for furnishing and setting a new steam boiler for the Seventh District Court-House, Fifty-seventh Street. The following were the bidders: P. Carraher, \$983; J. Jamer, \$1,221.

NEW YORK CITY.—Bids were opened at the Department of Public Works, October 20, for building a sewer in Ninety-first Street, between First and Second Avenues. The specification called for 755 lin. feet sewer, 500 cubic yards of rock excavation, and 5,000 feet, B. M., timber. The following were the bidders: J. P. Kerrigan, \$7,435; P. Larney, \$10,757.50; T. A. Smith, \$7,655.75; P. Reilly, \$8,064.75.

CHAUTAUQUA, N. Y.—The following proposals for dredging the outlet of Chautauqua Lake have been received by James Shanahan, Superintendent of Public Works, Albany, N. Y.: Willard Johnson, Fulton, N. Y., 21½¢ per cubic yard; E. A. Burroughs, Jamestown, N. Y., 24¢; Ross & Sanford, New York, 27¢; Kingston & Woods, Buffalo, 28¢; Grace & Stratton, Pittsburg, \$1. The contract was awarded to Willard Johnson.

MILWAUKEE, WIS.—Abstract of bids for constructing brick sewers in North Avenue, West Sewerage District, opened October 11: James Markey, 91 feet of 72-inch, \$14 per foot; 55 feet of 48-inch, \$12.60 per foot; 245 feet of 42-inch, \$12.25.

John S. O'Neil, \$16, \$15, \$15.

William Forrestal, \$15.85, \$14.75, \$13.75.

John O'Neill, \$16.75, \$14.25, \$13.50.

John C. F. Brand, \$15, \$15, \$15.

It is worthy of note that James Markey is putting in a 72-inch sewer in Brown Street for \$7.23 per foot. The board has refused to let the contract for North Avenue.

MILWAUKEE, WIS.—Abstract of bids for sewer in Fowler Street: William Forrestal, \$11 per lineal foot; John O'Neill, \$12; John C. F. Brand, \$8.75; Henry Vogt, \$8.70; Charles Brandt, \$8.65; James O'Donnell, \$8.39.

MILWAUKEE, WIS.—The contract for building a sewer in Bismarck Avenue was let to Thomas Morrissey at \$5.80 per foot for brick, and \$2.40 per foot for pipe-sewer.

NEW HAVEN, CONN.—The following bids for constructing pile and timber foundation (3,500 lineal feet) for sewers were received by Albert B. Hill, City Engineer, October 19:

William E. Alling, New Haven, Conn., \$7.90 per foot.

A. Brazos & Sons, Middlefield, Conn., \$7.90.

John & George H. Cavanagh, Boston, Mass., \$7.

C. R. Waterhouse, Jr., New Haven, Conn., \$6.45.

Laurence O'Brien, New Haven, Conn., \$6.25.

Bruen & Shepard, New Haven, Conn., \$6.13. Awarded the contract.

MILWAUKEE, WIS.—For sewer in the South Sewerage District:

BIDDERS.	Price per lineal foot.			
	700 ft. of 36" sewer.	422 ft. of 30" sewer.	135 ft. of 15" sewer.	184 ft. of 12" sewer.
John O'Neil	\$7.30	\$6.80	\$1.99	\$1.90
J. C. F. Brand	6.00	4.90	1.70	1.50
John S. O'Neil	6.00	4.75	1.80	1.40
Patrick Drew	5.83	5.40	2.23	1.80
Henry Vogt	4.30	3.35	1.65	1.45

The contract was let to Henry Vogt, October 14.

FOND DU LAC.—Bids for constructing a bridge at Arndt Street were opened October 3, as below:

E. A. Spalding, Dubuque, Iowa, \$710.

King Iron Bridge and Manufacturing Co., Cleveland, O., \$1,075, with iron piers.

Kansas City Bridge and Iron Co., four plans—plan A, \$695; B, \$689; C, \$635; D, \$600.

Wisconsin Bridge and Iron Co., two plans—A, \$630; B, \$590.

Groton Bridge and Mfg Co., four plans—plan A, \$585; B, \$700; C, \$780; D, \$875. The three latter plans contemplate iron joists.

A. Y. Bayne & Co., Minneapolis, three plans designated by weight, at \$600, \$645, and \$695.

Massillon Bridge Co., Massillon, O., two plans—No. 1, \$550; No. 2, \$580.

Wrought Iron Bridge Co., Canton, O., four plans—A, \$625; B, \$567; C, \$500; D, \$465.

Milwaukee Bridge and Iron-Works, presents two plans, both same price, \$620.

P. E. Lane, Chicago, \$675.

PETERSBURG, ILL.—The contract for constructing water-works has been given to D. Fisher; cost of works, \$20,000.

GOVERNMENT WORK.

HOT SPRINGS, ARK.—No award will be made upon bids for "officers' quarters" received the 29th ult., and the award for the "elevator" upon bids received the 5th inst. is in abeyance.

SYNOPSIS of bids for extension of Court-House, etc., at Harrisonburg, Va., opened October 18, by the Supervising Architect: P. Bradley's Sons & Billheimer, \$34,575; McCarthy & Baldwin, \$28,827.70; D. J. Macarty, \$28,300; J. E. Finsley, \$25,667; John O'Connor, \$57,504; W. A. Chesterman, \$33,996; L. D. Willcutt, \$33,549; C. A. Macater, \$33,000; James H. Coster, \$29,982.

SYNOPSIS of bids for heating apparatus for Court-House, etc., Erie, Pa., opened by the Supervising Architect: Bartlett, Hayward & Co., \$15,500, 1-inch vertical radiator; William J. Butler, \$10,740, Brook's or Crane radiator, 5'x7½" Sturtevant fan.

ARKANSAS RIVER.—Capt. H. S. Taber, U. S. Engineers, has written a letter on the improvement of Arkansas River, by maintaining a 5-foot depth to Little Rock, by dykes. The cost is estimated at \$750,000 per annum, divided into \$250,000 for each of three reaches; the time from seven to ten years.

SYNOPSIS of bids for materials, tools, and labor for plumbing at Waco, Tex., opened October 17:

P. Nacey, all work, \$4,739; basement, \$1,511.33; basement and second story, \$2,732.67; basement and third story, \$2,688.66.

Paul Shean, \$3,750; \$2,500; \$3,150; \$3,200.

May & Wainright, \$4,518.14; \$2,932.04; \$3,744.39; \$3,705.89.

Manion & Co., \$3,490; \$2,330; \$2,910; \$2,910.

WASHINGTON, D. C.—Proposals for bids for making the excavation for the new Government building at Reading, Pa., were sent out October 14. The new building will cost about \$100,000.

SYNOPSIS of bids for steam-heating apparatus for Custom-house, etc., Belfast, Me., opened by the Supervising Architect: George T. Read, \$1,545.

SYNOPSIS of bids for labor and material for plumbing and gas-piping for Post-Office, etc., Concord, N. H., opened October 17 by the Supervising Architect: James P. Farrel (no check), \$3,979; Crooks, Horner & Co., \$4,374.65; John F. Dalton, \$3,802.

WASHINGTON, D. C.—Bids opened by Edward Clark, Architect of the Capitol, for the marble balustrade, October 12:

John Tobin, New York, \$14,840.
Fanning & McElwee, Washington, D. C., \$11,861.50.

Vermont Marble Co., Proctor, Vt., \$11,445.
Lane & Malnati, Washington, D. C., \$9,972.

SYNOPSIS of bids for life-saving station at Narragansett pier, opened October 20: Francis H. Smith, New York City, \$11,450; A. F. Blossom, New Bedford, Mass., \$15,000; Lewis F. Bell, Wakefield, R. I., \$8,300; James Thompson, Rosebank, N. Y., \$8,125.

FAR ROCKAWAY.—The contract for building the life-saving station has been awarded to Francis H. Smith, of New York, at his bid of \$4,894.

SYNOPSIS of bids for steam-heating and ventilating at Aberdeen, Miss.: Bartlett, Hayward & Co., \$3,500, 1 vertical, own, radiator; Wm Kirkup & Son, \$4,980, 1 vertical, own, radiator (opened by the Supervising Architect October 10).

SYNOPSIS of bids for stone, brick, iron, and earth work of approaches to Post-Office and Court-House at Hannibal, Mo., opened October 7 by the Supervising Architect: Larkworthy & Menke, \$7,348, \$6,585 (Bedford Limestone instead of granite).

MISCELLANEOUS.

FORTORIA, O.—Glass-works will be erected here by the Butler Decorative Art-Works.

MANKATO, MINN.—The Formosa Town Company, of Mankato, has been chartered; capital stock, \$10,000; R. G. Patterson, of Omino, President.

NEW YORK.—The Hall Steam-Pump Co., 91 Liberty Street, New York, is in the market for some machinery to increase their manufacturing facilities. For full information address E. J. Waring, General Manager.

ST. PAUL, MINN.—Incorporated are the East Happenyan Iron Mining Company, of Minneapolis. Capital stock, \$1,000,000. Incorporators, John Paulson, Fred. Farnsworth, Jr., Millard P. Andrus, Olney J. Nevitt, Minneapolis, and others.

INCORPORATED—Chicago Well Works; capital stock, \$20,000; incorporators, M. L. Chapman, Mark C. Chapman, and G. E. Sperry, and by the same the Aurora Well Works, with a capital stock of \$10,000. The Chicago Diamond Drill Company; capital stock, \$25,000; incorporators, M. L. Chapman, F. J. Lukens, and George Bates.

CHELSEA, MASS.—Messrs. Montgomery & Howard, shipbuilders of this city, have contracted to build a freight steamer for the Old Colony Steamship Company to run between Fall River, Providence, and New York.

CLEVELAND, O.—The Cleveland Dry Dock Company are to build a steamer for a Cleveland syndicate. Estimated carrying capacity, 2,100 tons of ore, and the cost, \$120,000.

ROME, GEO.—Address J. D. Williamson, President Rome and Carrollton Construction Company, in regard to bids for building 100 miles of Chattanooga, Rome, and Columbus Railroad.

MAUCH CHUNK, PA.—The Mauch Chunk Electric-Light Company has been incorporated; capital stock, \$1,500.

SPRINGFIELD, ILL.—The following companies have been incorporated: St. Louis Granite Company, of East St. Louis, Ill.; capital stock, \$50,000; object, to engage in the business of stone contractors; incorporators, W. H. Swift, John B. O'Meara, and August Heman.

ATLANTA, GEO.—Proposals are wanted for the material and work necessary to improve the superintendent's lodge at the Natchez, Miss., National Cemetery. Until October 25 address E. B. Kirk, Major and Quartermaster U. S. A., Rooms 44 and 46, Gate City Bank Building, Atlanta, Ga.

INCORPORATED are: The Twin City Power Company, for the purpose of drilling for natural gas and oil, and doing a general mining business, with a capital stock of \$500,000. The interested parties are George W. Cross, Edward S. Bean and J. J. O'Connor, of St. Paul, and the total amount of indebtedness shall never be over \$200,000.

LOS ANGELES, CAL.—A standard-gauge railroad from Salt Lake City to Los Angeles is contemplated. At a recent special meeting of the Board of Trade resolutions were adopted favoring the project, and pledging the support of the board in carrying out the plans.

LINCOLN, NEB.—The Pacific Railway of Kansas and the Pacific Railway of Nebraska have been consolidated. The consolidated road will run from Wamick, Kan., to Hastings, Neb., and has increased its capital stock to \$2,000,000. The work on this road has been commenced.

INCORPORATED is the Newburg, N. Y., Iron-Ship Building Company.

SAN JOSE, CAL.—The California Windmill Company has been incorporated; capital stock, \$100,000; the directors are J. P. Pierce, R. T. Pierce, W. J. Casey, of Santa Clara; James H. Pierce, of San Jose, and George P. Thurston, of San Francisco. In addition to windmills, the company will manufacture engines, pumps, grinding mills, etc. The headquarters of the new company will be at Santa Clara.

AURORA, PA.—The Aurora Wells Works has been incorporated; capital stock, \$10,000; J. F. Jenkins, G. E. Sperry, and M. C. Chapman, incorporators.

PUBLICATIONS RECEIVED.

ANNALI DELLA SOCIETA DEGLI INGEGNERI E. Degli, Architeti Italiani. G. C. Baravelli Engineer.

CONSTITUTION AND BY-LAWS of the Washington Chapter of the American Institute of Architects. J. L. Smithmeyer, President.

SIXTEENTH ANNUAL REPORT of the Board of Water Commissioners to the City of New London. W. H. Richards, Superintendent.

TRANSACTIONS OF THE MEDICAL AND CHIRURGICAL FACULTY of the State of Maryland. Eighty-ninth Annual Session, held at Baltimore, Md., April, 1887. G. Lane Taneyhill, M. D., Recording Secretary.

FOURTEENTH ANNUAL REPORT of the Trustees of the Toledo Water-Works for the year ending December 31, 1886. J. A. Grauff, Engineer.

ELEMENTARY TREATISE on Analytical Mechanics. By William G. Peck, Ph. D., LL.D. A. S. Barnes & Co., New York. Publishers.

PROCEEDINGS OF THE TWENTIETH Annual Convention of Architects, held in New York City, December 1 and 2, 1886.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b, brown stone; br, brick; br st, brick store; As dwell, brown-stone dwelling; apart house, apartment-house; ten, tenement; c, each s. owner; a, architect; b, builder; fr, frame.

NEW YORK.

N w cor 4th av and 118th st, 4 br flats; total cost, \$79,000; o, Christeanne Kehoe; a, Alfred Kehoe.

S s 117th st, 150 e 8th av, 2 br flats; total cost, \$30,000; o, Wm B Domihee; a, Andrew Spence.

N s 131st st, 175 w 10th av, 4 br flats; total cost, \$60,000; o, Jas T. Meagher; a, same as above.

E s Broadway Boulevard, 25 s 95th st, 2 br flats; total cost, \$68,000; o, Thos Wren; a, Chas Baxter.

S s 138th st, 34 w Brown Place, 9 br flats; total cost, \$126,000; o, John C. Bushfield; a, same as above.

S w cor 138th st and Brown Place, br flat; cost, \$25,000; o and a, same as above.

S s 101st st, 250 e ad av, 4 br tens; cost, \$50,000; o, Alb Pietrowski; a, same as above.

S e cor Broadway Boulevard and 95th st, br store and dwell; cost, \$40,000; o, Thomas Wren & Co.; a, C Baxter.

ALTERATIONS—NEW YORK.

No 404 W 54th st, br dwell; cost, \$7,000; o, Henry W Gordon; a, James Stroud.

BROOKLYN.

N e cor Willoughby and Maury av, br dwell; cost, \$12,000; o, C C Reynolds; a, Amzi Hill.

S s 14th, 322 E Sixth av, 3 fr dwells; cost, \$7,500 all; o and a, Wm Hawkins.

E s Schenectady av, 92 s Herkimer, 5 fr dwells; cost, \$10,000 all; o, J F Sullivan; a, W H Waldron.

37 Moore, fr ten; cost, \$6,300; o, Adolph Koelher; a, Th Engelhardt.

S s Ivy, 280 e Central av, 2 fr dwells; cost, \$6,000 all; o, Mary Kenney; a, not given.

N s Bergen, 100 w Bedford av, 2 br dwells; cost, \$12,400 all; o, A J Brownell; a, Geo Daman.

N s Rutledge, 280 e Harrison av, 2 br tens; cost, \$13,000 all; o, Beck & Stolz; a, John Platte.

N s Rutledge, 340 w Harrison av, br dwell; cost, \$6,000; o and a, as above.

BUILDING INTELLIGENCE.

BROOKLYN—(Continued).

N s Troutman, 130 w Harrison av, fr dwell and stores; cost, \$7,000; o, Louis Maden; a, not given.

S s Ten Eyck, 90 e Lorimer, 2 br dwells and soda water factory; cost, \$10,000 all; o, T L Neff; a, Th Engelhardt.

N s Flushing av, 113 e Morgan av, 3 fr tens; cost, \$10,500 all; o, Joseph Herte; a, Franz Herte.

E s Ocean pl, 87 s Herkimer st, 4 br dws; cost, \$18,000 all; o, Richard Robbins; a, Wm Godfrey.

W s Gunther pl, 87 s Herkimer st, 4 br dws; cost, \$15,000 all; o, Richard Robbins; a, Wm Godfrey.

N e cor N Second and Lorimer, br dw and store; cost, \$11,000; o, Chas Susseick; a, Th Engelhardt.

N s Douglass, 350 w Fifth av, 3 br dws; cost, \$9,000 all; o, David Dow; a, David Dow.

MISCELLANEOUS.

NORTH HAVEN, CONN.—School bldg in Fourth District.

BRIDGEPORT, CONN.—Robert Houston is to build a house on Main st, near South av, from the plans of Longstaff & Hurd; cost, \$3,500.

Two old-style cottage houses in Park place are to be transformed into houses of modern design, from the plans of Longstaff & Hurd. P. T. Barnum is the owner.

Longstaff & Hurd have made plans for a residence to be erected at Seaside Park by Sherman Hubbard; cost, \$12,000.

Estimates are now being received for the erection of a house on Clinton av, near North av, for S. H. Patterson, from the plans of Henry A Lambert.

BALTIMORE, MD.—Green nr Lexington, 4-story br warehouse; o, A Roseta.

Cor Preston and Hunter al, 4 3-story bldgs; o, C H Callis.

Cor Biddle and Hunter al, 4 3-story br bldgs; o, C H Callis.

Cor Lombard and Ance, 3-story br bldg; o, N R Gill.

Pratt nr Charles, 5-story br warehouse; o, Jas D Mason.

Pratt nr Charles, 4-story br warehouse; o, Jas D Mason.

Pratt nr Charles, 4-story br warehouse; o, Lebrandt-McDowell Stove Co.

Monument nr Anne, 2 3-story br bldgs; o, H L Franz.

Central av nr Mullikin st, 3 3-story br bldgs; o, Fred Hausler.

LANDSDOWNE, IOWA.—First Presbyterian Church.

DAYTON, O.—Government bldg here on Main and Fifth sts.

ATHENS, ALA.—Dwell; o, Judge Horton; contracts let.

KANSAS CITY.—13th and Central, stone church; cost, \$117,000; o, Grace Episcopal Church Society; a, A Van Brunt.

1216-18 Grand av, stone and br store; cost, \$30,000; o, T H Prest; a, Knox & Guinotti.

Kansas av, bet 13th and 14th, pyramida; cost, \$7,000; o, Craig & Hamilton.

Holmes, cor 10th, 3 story br dwell; cost, \$15,000; o, L Bacon.

Vine, cor 18th, 3 story br store; cost, \$10,000; o, Lieberman & Oppenheimer; a, S E Chamberlain.

Frost av, cor 17th, 4 story block dwells; cost, \$15,000; o and a, same as last.

116 bldgs costing less than \$7,000.

ST PAUL, MINN.—7th, cor Arcade, 2-story fr stores and dwell; cost, \$14,000; o, H F Stock.

58 minor permits \$51,000.

JAMESTOWN, N Y.—New Kent House bldg; cost, \$200,000; o, B L Wood, Jr., of Pittsburg; landlords, Shuey & Frisbie.

LEWISTON, ME.—Architect Coombs, of this city, has prepared plans for the Observatory of Bates College.

HARTFORD, CONN.—Bldg for Hartford Electric-Light Co.

DARIEN, CONN.—Methodist Church in progress.

GEORGETOWN, TEX.—Br bldg; o, Capt. Emzy Taylor.

WORCESTER, MASS.—Alt to City Hospital; a, Barker & Nourse.

PUEBLO, COL.—Union depot; cost, \$150,000.

ST. PAUL, MINN.—Theatre on Cedar Street; cost, \$200,000.

DULUTH, MINN.—E A McNair, of Lewis & McNair, agent of the Equitable Life Insurance Company, of New York, says the company will erect on Superior st a \$300,000 bldg.

SPRINGFIELD, MASS.—Willow st, 4-story br block; cost, \$24,000; o, Taylor & Topley; a, J Perkins; b, C W Shattuck and J S Sanderson.

McKNIGHTVILLE, MASS.—The Messrs J D & W H McKnight have under different stages of erection 16 cottages, some of wood and some of brick and wood, ranging in price from \$2,500 to \$15,000.

PROVIDENCE, R I.—Nothing over \$7,000 this week.

15 permits less than \$7,000.

ARLINGTON, MASS.—Fr dwell for Rev Richard Tolman; cost, \$5,000; b, O B Marston; a, E J Lewis, Jr., Boston.

BUILDING INTELLIGENCE.

ABINGTON, MASS.—A new depot will be built here.

ABILENE, KAN.—A \$15,000 city hall here.

PHILADELPHIA.—Hope Presbyterian Church, 38th and Wharton sts, in progress.

LINCOLN, NEB.—The contract for the erection of the industrial college building on the university campus at Lincoln has been let for \$41,000.

LOS ANGELES, CAL.—Griffith blk on Hill st; o, J M Griffith.

BEAVER CITY, NEB.—\$12,000 court-house here.

PITTSBURG, PA.—2 new school bldgs at Ingram and at Sheridan.

CEDAR RAPIDS, MICH.—Bld for Electric-Light Co. on D av.

WALTHAM, MASS.—In progress bldg for A O U W; F. Jarvis, President.

NORRISTOWN, PA.—New school bldg at the west end. Address Board of Education.

BEDFORD, MASS.—Catholics have purchased a lot at the south end of the city, on which to erect a church and parochial school building for the benefit of the French population.

DULUTH, MINN.—The Land and River Improvement Company has received the plans for a new \$80,000 hotel at West Superior. The substructure will be put in this fall.

BLACK RIVER FALLS, WIS.—A stock company will erect a large steam flouring mill.

MINNEAPOLIS.—O F Buell will build a \$75,000 br, stone, and terra cotta ten blk at the cor of Nicollet av and 17th st.

ASHMOUNT, MASS.—Lombard st, rubble stone and fr bldg for Ashmount Hall School Association; b, F M Severance; a, Edwin J Lewis, Jr., Boston.

OCALA, FLA.—Br Episcopal Church.

HEMPSTEAD, L. I.—Baptist Church 65x70 feet. Residences are being erected for John McLean, Edward Flannigan, William Doxey, Louis Cohen, Harry Akley, and George D Smith.

TERRYVILLE, L I.—Town hall bldg.

BAY SHORE, L I.—Cottage; o, Frank P Pike.

ROME, N Y.—Madison st, br addn and hospital; cost, \$4,000; o, N Y I for Deaf Mutes; a, Withers & Dixon, Albany; b, contract not let.

2 wrought iron bridges; cost, \$3,500; o, city of Rome; a, G C Schiller, Engineer; b, Canton Bridge Co.

MILWAUKEE.—Wm H Bradley, 212 Wisconsin st, will build a \$10,000 res at his summer resort about 3 miles from Oconomowoc.

10th, between Chestnut and Prairie, fr elevator; cost, \$10,000; o, Ph Best Brewing Company; b, Osca Knie.

3d, between Lee and Wright, br store; cost, \$10,000; o, A Strauss; b, H Schmitt & Co.

N w cor 14th av and Woodstock pl, br res; cost, \$15,000; o, S Wohrab.

Clinton st, br foundry; cost, \$8,000; o, Tiler & Stowell Co.

Cape, factory; cost, \$10,000; o, Schroeder Lumber Co.

Galena, br dwell; cost, \$9,000; o, J C Schroeder.

Grand av, br dwell; cost, \$8,000; o, Wm Steinmeyer.

Sixth, double dwell; cost, \$8,000; o, J Kraatz.

Cold Spring av, church; cost, \$7,500; o, Lutheran Trinity Church.

25th, dwell; cost, \$10,000; o, G A Parker.

Lake av, br laundry; cost, \$7,000; o, Industrial School.

Racine, br dwell; cost, \$7,000; o, Albert Wallber.

Menomonie, alt; cost, \$10,000; o, Mann Bros.

3d, br store; cost, \$18,000; o, Kahn Bros.

87 bldgs under \$7,000.

BOSTON.—44-50 Palmer, br dwells; cost, \$7,000 each; o and a, J G W Mason; b, J Nickerson.

Spice, near Cambridge, fr brass foundry; cost, \$9,000; o, Deste & Co; b, G T Burnham.

Waukegan, fr dwell; cost, \$7,500; o, Neil McNeil; a and b, McNeil Bros.

LITCHFIELD, ILL.—Br blk, 62½x124 feet, steam-heat; o, Thomas Rhodes.

CHATTANOOGA.—Montgomery st, br school house; cost, \$18,000; o, City; a, R H Hunt; not let.

CHARLEVOIX, MICH.—A Baptist church will be built here.

BIRMINGHAM, ALA.—A Union Depot will be erected here; also a new hotel.

(Continued on page 593.)

TOO LATE FOR CLASSIFICATION.

CAMDEN, N. J.—The Supervising Architect of the Treasury has rejected all bids on the Government Building here, and will receive new ones until the 28th inst.

PLAINFIELD, N. J., Common Council has contracted with the Plainfield Electric-Light Company to light the city entirely by incandescent lamps.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 22. } PUBLISHED EVERY SATURDAY.

NEW YORK, OCTOBER 29, 1887.
LONDON, NOVEMBER 12, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 20, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

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THE HEALTH OF MASSACHUSETTS.

FROM the forty-fifth registration report of the State of Massachusetts, for the year 1886, we learn that there were recorded during the year 50,788 births, 18,018 marriages, and 37,244 deaths. A fair estimate of the population is 1,976,264, giving a birth-rate of 25.69 and a death-rate of 18.85 per 1,000. This is a lower death-rate than that of any previous year since 1879.

Of the counties Nantucket has the highest death-rate—viz., 32.8—and Franklin the lowest—viz., 16.1; that is to say, the death-rate in Nantucket was a little more than double that of Franklin. But the total number of deaths in Nantucket was only 103 and in Franklin 608, and for such small numbers the probable error in ratios is so great that it is difficult to make reliable comparisons in this way. When we turn to the causes of death and find that in Nantucket 23 deaths, or 21 per cent. of all the deaths, were due to diphtheria and croup, 7 per cent. to shipwreck, and 11 per cent. to old age, it is evident that the high death-rate is in part accounted for.

These registration reports are among the best work which Massachusetts is doing. They are the best of the kind in this country, the data are fairly complete and accurate, and they are well tabulated. Very few at present appreciate their value and importance, but each succeeding year will increase this appreciation, and they form a substantial and enduring record of the most valuable possession of the State—viz., the life and health of its citizens.

Every library and every health officer in this country should take care to secure these annual volumes as they appear, and every State should endeavor to obtain for itself similar records.

EADS' LAST WORK.

THE extraordinary success achieved by the late Captain James B. Eads as a financier and a promoter of vast enterprises have led many to comparatively underrate his pre-eminent abilities as an engineer, considering it hardly possible that any one man could combine in himself such varied gifts in such a high degree, or if they gave him credit for being an engineer at all it was only as an engineer in a large and general way—one capable of conceiving great things, but having to depend for their successful achievement on the able assistants with whom he always surrounded himself, and this mistaken opinion has been strengthened by the generous way in which he always gave his assistants all the credit that was possibly due them.

To show his abundant ability not merely to originate gigantic schemes, such as but few men would have dared to undertake, even had they been able to conceive them, but also to skillfully and minutely plan all the varied details necessary for their practical accomplishment, we are pleased to be able to give a letter written about ten days before his death to an engineer of this city, and to reproduce some sketches from his hand on another page. In so doing we feel we shall also gratify the natural interest that all must feel in the last work of so great a man. Moreover, we cannot disguise the satisfaction, tinged with sadness though it be, that we feel in writing of one about whom we know that the best that can be said is not too much to say.

A SUGGESTION FOR THE BUILDING LAW.

BEFORE the echoes of the fall of that Harlem school-house have died away it may be well, as one of its causes was "dangerously rapid work," to suggest that the speed as well as the character of such work be regulated by law; in other words, that not more than so many feet be allowed to be added to the height of a wall each day.

It is useless, however, to improve the building law if it is not enforced. If the law provided that no wall should be more than ten feet high or less than ten feet thick, buildings would continue to fall down just the same under such methods of inspection as prevailed until recently in at least one district of this city.

THE EFFECT OF TEMPERATURE UPON STRUCTURAL IRON OR STEEL.

OUR readers will find in this issue some extracts from a very interesting paper on "The Effect of Temperature on Structural Iron and Steel," read by Mr. Joseph Ramsey, Sr., at the regular monthly meeting of the Engineers' Society of Western Pennsylvania held in Pittsburgh on the 18th inst. We regret that lack of space compelled us to omit from the paper several valuable tables giving in detail the results of Mr. Ramsey's experiments and tests.

WE quote elsewhere from the Washington *Star* its report of a decision by Chief Justice Bingham, in which the Commissioners of the District of Columbia were required to issue a permit to a plumber of that city who contested their right to enforce certain regulations promulgated by them. It will be seen that the court recognized the propriety of the regulations and the duty of Congress to confer the power on the commissioners to make and enforce them, but it was reluctantly compelled to issue a mandamus on the ground that the original act did not confer the necessary authority. There is no doubt that this decision will result in their securing the needed powers from the next session of Congress, so that their temporary defeat will have the effect of securing them the authority which it seems they have hitherto lacked.

THE New York *Sun* has some time since directed the attention of our capitalists to the profits likely to result from an undertaking which would provide the city of Mexico with a good system of drainage and sewerage, the first important work being the drainage of the valley of Mexico, so as to make it practicable to construct a sewerage system for the city. This is not a new project. A beginning even has been made, as we noticed last fall; but the work seems to be delayed, waiting for some contractor with strong financial backing to take it up and carry it through to completion. Probably the reason why American capital has not yet turned to this quarter is one lightly treated by the *Sun*—viz., the want of confidence in the stability of Mexican institutions and in the ability of the Government to discharge the obligations which this work will incur. But the Mexico of to-day is a very different Mexico from the turbulent country of the days following the French invasion. The country is quiet, and the Government is able to maintain peace and order, and

is said to be able to meet all its obligations regularly. Of the natural riches of the country and the advantage of this work to the city of Mexico there is no question. We are of the opinion that Mexico offers one of the most promising fields for American enterprise and capital.

HEALTH REPORTS OF GERMANY.

THE first and second parts of Volume II. of the Special Reports issued by the Imperial Board of Health of Germany have recently been published in the form of a quarto volume of 222 pages, with maps and illustrations.

It contains a paper on micro-organisms in artificial seltzer-waters, by Dr. Hochstetter; a report on the cholera outbreak in Sosenheim and Finthen in the fall of 1886; a report on the results of vaccinations in Germany in the year 1883; a paper on tests of waters at Rudolstadt, by Dr. Wolffhügel; a report on lead and zinc in the arts and in daily life as sources of danger

more advisable to build a new bridge or tunnel at that point, so, at a recent meeting, they decided to invite General John Newton, Mr. E. B. Van Winkle, Mr. G. W. McNulty, and Thomas C. Clarke to examine the locality and advise as to the relative advantages of a fixed bridge, a draw-bridge, or a tunnel, with estimates of cost. A viaduct from Washington Heights to McComb's Dam Bridge is also in contemplation, and plans for a structure to cost about \$800,000 are nearly completed.

At the Hygienic Congress at Vienna, Herr Pettenkofer, lecturing on hygienic education and the necessity of spreading hygienic principles among all classes of society, largely quoted English authorities, and in alluding to the English proverb, "Cleanliness is next to Godliness," remarked that the statistics of the mortality of London show how hygienic piety has been rewarded by Heaven. Here is comfort and encouragement indeed for apostles of hygiene, toiling in the narrow way that leadeth unto life. —*London Builder.*

perfect. He quotes an instance where the electricity in passing from link to link encountered a resistance sufficient to enable it to partly fuse the chain. A lightning-rod without sufficient earth connection is worse than useless, as it invites a danger which it cannot avert. It is the lower end of a lightning-rod that is emphatically its "business end."

AFTER a series of experiments to decide the question of the superiority of the gelatine as compared with the water cartridge made at the North Staffordshire Mining Institute, it has been decided at the Shelton collieries to use the gelatine cartridge.

WE are promised from Paris a new excitement in the shape of a steam balloon. The form of this contrivance is to be that of a fish, with a length of about 200 feet, suspended from which will be the car carrying a steam-engine weighing 1 ton 13 cwt. connected to a screw. The I. H. P. is 70, and the inventor anticipates a speed of about fourteen miles an hour.



A GARDENER'S COTTAGE.—M'KIM, MEAD & WHITE, ARCHITECTS.

to health, by Dr. Wolffhügel; and a report on the mortality of infants in Germany during the years 1875-77, by Dr. Würzburg. All of these are careful, thorough pieces of work, the force and value of which can only be appreciated by practical men.

IN view of the Kouts railroad disaster, in which the car-stove caused the death of some dozen or more people, it would seem that the law of this State will require amendment at the next session of the Legislature, since under this law railroad companies are allowed to keep a fire in a car when standing still. This train happened to be standing still with a broken engine and another engine ran into it; but the car-stove did the damage just the same.

THE Board of Estimate and Apportionment of this city has decided that it would be a waste of money to spend \$60,000 in repairing McComb's Dam Bridge and the Park Commissioners are of the same opinion, believing it to be

A COMPRESSED-AIR locomotive for underground work for mines, etc., is exhibited at the Newcastle Exhibition, and it is stated that several such engines are in use in the Durham Mines. The locomotive runs on a 33¼-inch gauge, and its total weight is about two tons. The pressure of the air is about 400 pounds to the square inch. On a medium road the maximum load of the engine is twelve tons, and with five tons the air charge will last about a mile.

LIGHTNING-CONDUCTORS.

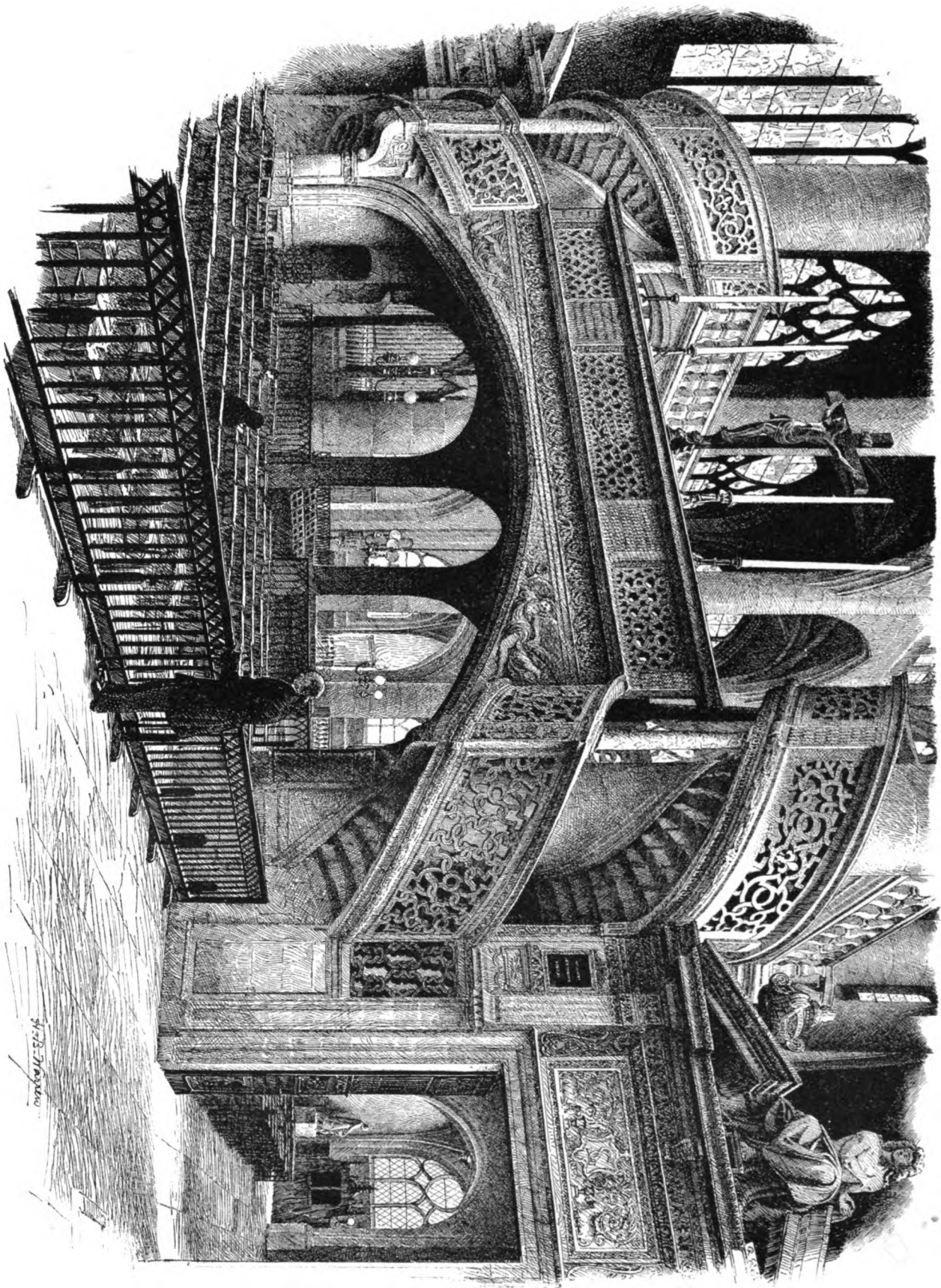
APROPOS of the recent prevalence of thunder storms, Professor Tyndall has been drawing attention to the best methods of connecting lightning-conductors with the earth. He points out that conductors are very frequently laid in the earth without any terminal plate whatever, that the abolition of resistance is absolutely necessary in connecting lightning-conductors with the earth, and that this is best done by closely imbedding in the earth a plate of good conducting material and of large area. He objects to chain cable for the purpose of prolonging a conductor, on the ground that the contact of link with link is never

AMERICAN INSTITUTE OF ARCHITECTS.

WE devote considerable space in this issue to a report of the twenty-first annual convention of the American Institute of Architects held at Chicago. As will be seen, this session was of more than usual interest. A number of good papers were read, abstracts of which we hope to give our readers in future issues. All those attending felt their appreciation of the liberal hospitality extended by the Illinois Society of Architects and the Chicago Chapter. The members were entertained three days at lunch, carriages furnished for drives about the city each afternoon; indeed, everything was done to make their stay pleasant and profitable in that interesting and remarkable city. Mr. Walter and Mr. Bloor declined a re-election as President and Secretary respectively. Mr. Richard M. Hunt was elected President, and Mr. William A. Potter Secretary.

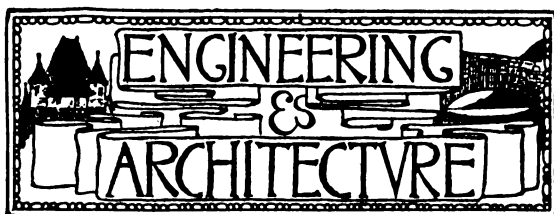
OUR ARCHITECTURAL ILLUSTRATIONS. INTERIOR OF ST. ETIENNE-DU-MONT, PARIS, FRANCE.

A GARDENER'S COTTAGE.—M'KIM, MEAD & WHITE, ARCHITECTS.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

INTERIOR OF ST. ETIENNE-DU-MONT, PARIS, FRANCE.



ON THE MANUFACTURE OF SALT NEAR MIDDLESBROUGH.

FROM a paper by Sir Lowthian Bell, read before the Institution of Civil Engineers, we abstract the following interesting data. This salt bed, near the mouth of the Tees, was discovered through an attempt made by Messrs. Bolckow & Vaughan to obtain pure water for their engines. The deposit, so far as developed, covers about $7\frac{3}{4}$ square miles, is from 1,090 to 1,674 feet below the surface, and varies in thickness from 65 to 117 feet, and the various strata contain from 98 to 37 per cent. of salt. The author estimates the total quantity at 100,000,000 tons, one acre of pure salt one inch thick weighing about 100 tons.

The estimates of the cost of sinking a shaft through the wet strata to the salt varied from £100,000 to £200,000, and it was determined to introduce water and extract the salt by pumping the resulting brine. Accordingly a tube, say 12 inches in diameter, with a series of holes near the bottom and another series of holes near the top of the salt, was sunk a short distance into the limestone floor of the mine so as to anchor it. Another pipe having an annular space of from 2 to 4 inches, with a series of holes near its bottom, is sunk inside of the larger pipe, with its lower end also anchored in the limestone. The water is introduced through the annulus and is pumped through the minor tube, which has a clack-valve some distance below the surface.

The water passing through the holes in the water-pipe dissolves the salt, gradually forming a cavity in the shape of an inverted cone, as the pure water, which is lighter than that nearer saturation, takes up the larger percentage of salt.

The rate at which the salt is dissolved depends, of course, on the extent of surface exposed to the action of the water. This at first is very slow, and for some months the quantity of salt furnished by a well is inconsiderable and the brine is weak.

A fully-saturated brine contains $26\frac{1}{2}$ per cent. by weight of salt and has a specific gravity of 1.204, hence a column of pure water 100 feet high will balance about eighty-three feet of saturated brine. The clack-valve should be some distance below this point.

A pump working eight hours per day is considered to do well if it raises 250 tons of salt per week. Seventeen wells now in use about Middlesbrough are thought to raise from 2,700 to 3,000 tons per week, or less than 180 tons each.

The plan adopted, though economical, is objectionable because the large extent of unsupported roof left by this mode of operation invites falls, some of which have already broken the pipes, and the impure strata being attacked from the top, the earthy matters fall on the salt and prevent the water reaching all of it.

The brine is pumped into reservoirs and allowed to settle, and then evaporated in iron pans 60x20x2 feet, by the use of refuse coal or waste heat from the smelting furnaces.

About 2,250,000 tons of salt are made in England annually, one-eighth of which is brought to the banks of Tyne, and converted into soda by the Le Blanc or the Solvay process.

By the first method the salt is heated with sulphuric acid, producing "salt cake," and setting free chlorine, from which bleaching powder is made.

The salt cake is reduced to black ash by using 100 parts with 140 parts of broken limestone, and 40 to 70 parts of coal, and the resulting carbonate of soda is obtained by lixiviation. The waste in this process is sulphur; the sale of the bleaching powder, a by-product, adds to the profits of the operation, and sometimes is of greater value than the soda.

In the Solvay process ammonia and carbonic acid are forced through a pure lime, thus saving the cost of evaporation, giving bicarbonate of soda and chloride of ammonium, sal ammoniac. The bicarbonate of soda is roasted in a reverberatory furnace, where the adhering water, one equivalent of carbonic acid, is driven off, leaving a mon carbonate. Most of the ammonia is recovered by treating the chloride of ammonium with milk of lime; the chloride of calcium formed being run to waste.

AMERICAN INSTITUTE OF ARCHITECTS—TWENTY-FIRST ANNUAL CONVENTION.

CHICAGO, for the second time in its history, welcomed the American Institute of Architects, on the occasion of the twenty-first annual convention of the institute, October 19-21, and the attendance was the largest in years. The sessions took place in the rooms of the Literary Club, in the Art Institute, corner of Michigan Boulevard and Van Buren Street, while every noon, as the guests of the Chicago Chapter of the Institute and of the Illinois State Association of Architects, the assembly lunched at the neighboring Union League Club-house.

The first day, Wednesday, opened at 11 A. M. with an address, in the absence of President Thomas U. Walter, LL.D., detained in Philadelphia by severe illness, from First Vice-President Edward H. Kendall.

VICE-PRESIDENT KENDALL'S OPENING ADDRESS.
Fellow Members of the American Institute of Architects:
Having known for only two or three weeks that, owing to serious illness, our esteemed President, Mr. Walter, could not be with us to-day, I can do little more than call you to order, and formally endeavor to perform the duties of Chairman.

I shall ask you, however, to undertake the business of this our Twenty-first Annual Convention with that especial dignity of bearing and soberness of purpose which would seem to be called for upon the attainment of our corporate majority, and will remind you that we are called together in this great and prosperous city for the purpose of exchanging our annual greetings, of renewing our allegiance one to another, of giving evidence that we are competent to do the work required of us, of investigating the current developments in the science and art of our profession, and of increasing our usefulness to ourselves and to our clients in all possible ways.

We shall listen to papers from representative men upon subjects of especial interest, and reports of important committees must be heard and acted upon.

One of the greatest difficulties encountered by your Board of Trustees, now that our field is so much enlarged, is the frequent meagreness of information concerning candidates for membership, and, in order to reduce this difficulty to a minimum, must we not soon devise a better method than the present one of determining whether or not those who wish to join us are qualified by education, by business habits, and by personal characteristics to so influence public opinion that we may command the respect and confidence of the several communities in which we work?

Whether the present method can be made sufficient by a keener sense of responsibility on the part of those who know the applicants for fellowship or associateship, or whether we should create an office, in the nature of a traveling secretaryship, the duties of which would be to come in personal contact with all our members and would-be members, and, by intercourse and correspondence, to make the institute more surely a common ground where the best instincts and interests of our profession should centre, is a subject which we ought soon carefully to consider.

We must all feel gratified by the growing interest taken in our institute, which is clearly shown by the unusually large number of applications for membership and of requests for information as to the organization of additional chapters during the past year, and you will all bear me out when I say that we are especially glad to have admitted so many who are also members of the Western Association of Architects.

It is our wish to have the active co-operation of all the best men in the profession, and the being a member of other associations or societies, instead of being a bar against, is in fact the very best reason for joining the institute, as it would then get the benefit of doubly-organized work, and the general welfare would be correspondingly advanced.

Then, again, we wish to see and personally know all those who are doing good work in this great country, and the day will soon come when these annual meetings will be eagerly looked forward to and be largely attended, and when they will be considered not so much from the standpoint of duty as from that of pleasure and privilege; then also will the American Institute of Architects accomplish its highest degree of usefulness when it becomes the chief vehicle of professional pleasures as well as of professional duties, and when, to the formal requirements of routine and committee, is generously added the fraternal leaven of impulse and comity.

Secretary A. J. Bloor read the report of the Board of Trustees. Nine meetings had been held since December 9. Twelve fellows and fourteen associates had been elected and one died. A new chapter was organized this year in Washington, where there was much architecture worthy of the national capital, the wedge-shaped sites affording such fine opportunities for pleasing display. A chapter had just been formed in Indianapolis in place of the Indiana Chapter, and correspondence was taking place with various parts of the country looking to the organization of other chapters. The Western Association of Architects had done well in memorializing Congress as it did; an harmonious request representing all architectural associations throughout the country must receive attention.

The Treasurer's report showed \$1,447.39 in the bank at different times during the year, of which \$1,210 came from dues, and the disbursements were \$1,288.36, leaving a present balance of \$159.13, with assets over liabilities about \$1,100. The nucleus (\$176.75) for building in New York City a permanent home for the Institute still remained a nucleus. [Laughter.]

Next, the Standing Committee presented a report, the first division being on education and written by Professor Ricker, of the University of Illinois at Champaign. The School of Architecture there had two courses—a building course, composed of nine studies in a single year, and meant for builders and mechanics desiring instruction in the rudiments. The second, or architectural course, was for young men preparing for the profession. No suitable text-books existing, lectures were resorted to. The elements of sanitary construction were taught, comprising the general principles of plumbing and drainage, supplemented by the use of engineering instruments. Original work from students was not required too soon. The history of architecture was very simple; but here again lectures were demanded, satisfactory text-books not existing. Students made sketch designs and architectural perspective was taught. On heating and ventilating the same lack of text-books was seen. No scientific topic existed on which the general public presumed it knew so much and really knew so little. The finally adopted plan of instruction on all these various subjects was to write out lectures with the typewriter, costing students little more than ordinary text-books. The present demand for draughtsmen throughout the West caused some disadvantage. It was difficult to get students to take the entire course, a considerable number of young men wanting to jump over the fences and make brick without straw. Some architectural schools were partly responsible for this, teaching but little mechanics, much less than that of the civil engineer, and naturally when it came to practical life and the survival of the fittest, students who had thus shammed went to the wall. The Champaign school gave the most thorough instruction possible and had the most complete apparatus obtainable. A State system of examination of architects was only a partial system; the foundation needed was a better education of the profession. Real improvement would come only in that way, the direct tests of annual and other examinations eliminating the ignoramus and the shyster.

Regarding "Publications," the Standing Committee reported that 750 copies of last year's convention journal had been issued by the secretary.

Then came reports from the various chapters of the institute, Baltimore leading off. During the past year Secretary Wilson reported that the chapter had regular meetings, but owing to the small membership they were not very well attended. The membership and general situation were in *statu quo*. The movement was still in progress for the passage of a satisfactory building law by the State.

Boston Chapter, as Secretary Edmund M. Wheelright reported, held monthly dinners, well attended, and at the several meetings attention was held by some special feature like the address of C. H. Blackall on his two years' travels, illustrated by sketches made by him; the drawings of the Algonquin Club, and essays by George Snell and others. Two prizes, aggregating \$100, were given the Massachusetts Institute of Technology, one for the best work in design, and the other for the best general work during the past year. Also, \$500 was given the Archaeological Institute of America toward publishing the report of the Assos Expedition. No fellows had joined during the year.

Chicago Chapter had increased in numbers to 27, and December 9 had elected L. D. Cleveland, President; W. L. B. Jenney, Vice-President; M. L. Beers, Treasurer; and Alfred F. Pashley, Secretary. A committee on Arrangements was appointed to act with the Western Association of Architects in welcoming the American Institute.

Cincinnati Chapter favored the union of the Western Association and the American Institute and of the local chapters, believing better results would follow. The Chamber of Commerce Building, the last designed by the late H. H. Richardson, and the new City Hall were buildings of the first class now in process of erection in the American Athens.

Indianapolis Chapter reported a situation satisfactory in all respects, with monthly meetings attended by three-fourths of the large membership and marked by very friendly and fraternal feeling, in place of the coolness and asperity too common in the resident profession, and the chapter now comprised every worthy architect in the city. The activity in building had been great, natural gas attracting large capital and construction enterprises. The Indiana State House, the City Hall and market building, and the coming monument (costing \$225,000) to the Indiana State Soldiers and Sailors, were examples.

New York Chapter, as usual, had done the greater part of its work through committees. The chairman of the committee on examining the New York building law, perfecting the same and presenting it at Albany for enactment, was elected chairman in a joint movement with the municipality, and the new building law is received with much interest. Modest mention was made of services by Messrs. Avery and Bloor. The chapter had passed memorial resolutions on H. H. Richardson, whose productions had not been surpassed by those of any other American architect, and whose career was an example to all aspirants, no matter how gifted in mind, of the value of careful training. At one meeting of the chapter H. O. Avery read a paper on the "Paris School of Fine Arts," since published in Scribner's. The Willard donation of between \$70,000 and \$80,000 to the Metropolitan Museum of Art would yield immediate practical benefits.

Philadelphia Chapter chronicled the great growth of local architecture the past year, in a large number of expensive office buildings, churches, residences, creating more demand on the architect's skill and services than perhaps ever before. In the erection of small dwellings

Philadelphia was still the "city of homes," both town and suburbs being covered with small houses. Chapter meetings were held with regularity and reasonable attendance.

Rhode Island Chapter, after supper at the monthly meetings, held divers discussions, competitive plans being the subject lately of a more formal debate. Secretary Edward G. Nickerson signed the chapter report.

San Francisco and St. Louis Chapters vouchsafed no reports.

Washington Chapter, Secretary Glenn Brown wrote, organized last June, and listened to a lecture, the first of a series, October 9.

The Secretary for Foreign Correspondence, Mr. Jenney, of Chicago, announced that he had but a meagre report. Nothing had occurred in twelve months demanding his good offices, he not even being called on to give a send-off to lucky fellows starting on their European travels. So he would have some younger, more energetic member as a successor. The first year he did very little, acknowledged the receipt of a New Year's card; the second year he did some better, and he was elected to a third term; but really he hadn't earned his salt.

As a Nominating Committee for the election of officers, Chairman Kendall named E. T. Nickerson, of Providence; Henry Lord Gay, of Chicago, and Mr. Smith, of Nashville; and on suggestion of Mr. Frederick, of Baltimore, two more were added—Mr. W. R. Briggs, on Mr. Frederick's motion, and Professor Ricker, on Secretary Bloor's motion.

Reports of special committees being in order, one was presented on the bill to provide improved methods in the architectural service of the Federal Government, in conference with Special Committee of the Western Association of Architects. The report stated that the bill would have to be introduced again at the next session of Congress and submitted a letter to that effect from Congressman A. S. Hewitt, who wrote that some member of the Committee on Buildings and Grounds who wanted to make a record must be procured to give his entire time to the matter. The report closed by recommending the continuance of the committee to bring the subject before Congress at its next session. So ordered.

On architects' protective associations, T. M. Clark, of Boston, reported that any action would necessitate exhaustive study of the laws of the several States and also special legislation.

On providing a permanent home for the institute, the committee reported that any such building should be fire-proof, in the business part of New York City, and complete in aesthetics and construction. A joint stock company should erect it and could realize five per cent. net, and have the upper floors set off for the institute. The report was "conditionally accepted, pending Mr. Bell's signature."

On a building contract for use throughout the United States, in conference with special committee of National Associations of Builders of U. S. A., the committee recommended the appointment of a committee of three to confer with the Western Association of Architects and the National Association of Builders and draft a contract properly protecting the interest of owner and contractor and submit the same to the next annual convention. So ordered.

The Chair named the following committees to consider the reports presented to the convention: On Trustees' Report, Messrs. Bell, Scofield, and Adler; on Auditing Treasurer's Report, Messrs. Burnham, Crapsey, and Drery; on other reports, Messrs. Cutler, McLoughlin, and Root. Greetings were read from the Alabama Association of Architects by W. S. Smith, President, and suitably acknowledged.

President Walter's condition was reported as very unfavorable.

The North-Western Terra-Cotta Company invited the convention to visit their works. Accepted, and Messrs. Jenney and Gay were named a Committee of Arrangements.

The exhibition of illustrations, it was announced, would not be ready for the evening, and instead the convention was invited to attend the Inter-State Exposition and inspect its art gallery and diversified clay-working machinery. After reference to Messrs. Jenney and Adler the invitation was accepted.

Thereupon an interesting discussion sprang up and lasted till the end of the day's session. Architect Adler, of Chicago, introduced it, asking how many members there were in the Institute.

"About 225 members in all," replied Secretary Bloor. "Yes, the old limitation of seventy fellows was abrogated some time ago."

Mr. Adler—What objection is there to making all members fellows at once?

Secretary—It would be simply going back on the old record.

Mr. Adler—Any architect who is not a villain, horse-thief, or boodler may and will become a fellow if he wishes, may he not? That is, it only requires that two fellows recommend him for advancement, that he be willing to pay additional dues, and that he shall not have made himself so obnoxious to his fellow members of the institute as to cause a number of them to write over their own signatures and protest against his admission.

Secretary—The trustees exercise their own discretion in the matter. We very frequently object to candidates. We have objected to a number during this last session. The by-law shows you that.

Mr. Adler—I have not read the by-laws. I have simply noted the practice.

Secretary—All I can tell you officially is that after nomination by two fellows a candidate must be elected by the

Board of Directors. [Then followed the reading of by-laws providing for communication with all fellows and associates regarding every new applicant.]

Mr. Adler—That is explicit enough, I grant. But is it not the case that where an associate is recommended for advancement to fellowship and these letters of inquiry are sent out, almost invariably no opposition is made, no adverse answers are received; that except with reference to people who are valoriously unprofessional in the management of their business, notoriously incompetent to discharge their ordinary duties, architects dislike very much to place themselves on record in remarks derogatory to their fellow practitioners; and is not the result really this, that as far as the information you obtain from members of the institute, or from chapters at least, these inquiries might as well not be sent out at all? Is it not a fact that you receive no information that would lead you to reject?

Secretary—A great many letters reach the Board of Directors which are very severe on the applicants for admission. They are considered and frequently affect the course of the matter. Vice-President Kendall will remember it.

Vice-President—Yes; we frequently have occasion to act on such representations. I know that some are put out—vexed—that they are not advanced at once. But the object has been to have the two grades. I was an associate for a great many years and I always looked on the position of fellow as placed higher, and I felt a certain diffidence about applying for the position, but was prevailed on later and am very glad to be one.

Secretary—We have been much more indulgent lately in case of candidates from Chicago. [Laughter.] We thought it proper to receive candidates from Chicago—from the Western Association of Architects. We were particularly indulgent [smiles], although the secretary had from Chicago one or two adverse letters.

Mr. Briggs—Is there any special qualification required in a fellow that is not required in an associate?

Secretary—Very often we don't know the candidate for associate by reputation; generally we do know the candidate for fellow.

Mr. Briggs—In case of a very prominent man, a man we all know, applying to this institute and wishing to become a fellow, how long must he be an associate, if at all, before he can become a fellow?

Vice-President—It is left to the discretion of the directors. There is no restriction. He might be elected fellow at once, or placed under probation, in some instances. But in case of younger members and in all ordinary cases we consider it well that they should become associates first.

Mr. Briggs—But it is possible to elect to fellowship outright?

Vice-President—It is.

Mr. Adler—It is my belief that we should either have absolute equality in membership throughout our organization, or if we have two grades of membership, that particular pains should be taken to guard the matter of admission to the higher grade, and perhaps also, as a means of securing that end, that a limitation as to numbers be set to the membership of this higher degree. And to test the sense of this convention upon these two points, I will offer first a resolution to the effect that from and after this date, all who are now associates of this institute be advanced to the fellowship, and that hereafter all members of the institute admitted shall at once become fellows.

Secretary—That resolution is inoperative, not having been submitted thirty days in advance of this convention.

Mr. Jenney wanted a reference to a committee of three to report to the next convention.

So voted.

Mr. Briggs—This is simply to report, I understand it, whether to admit the rank of associate or to make a most decided and strong distinction between it and the rank of fellow.

On a further motion by Mr. Jenney a modification was carried that the committee on reference be the duly elected trustees for the coming year.

Mr. D. Adler, fellow, then read a paper on "Theatres."*

The second day's session opened at 11:30 Thursday. Vice-President Kendall in the chair and a large attendance. A letter, regretting his absence, was read from Mr. Le Brun, of New York, of the Board of Trustees.

An amendment to the by-laws was carried prohibiting the election of professional architects to the position of honorary members.

Another amendment offered was to limit any man's service as President to two years consecutively, and conferring on an ex-President of two years' service and over seventy years of age exemption from payment of dues and the position of a Vice-President.

The Committee on Nomination of Officers presented a list that at once caused discussion, the nominee for President being Edward H. Kendall, of New York.

Mr. Kendall stated he regretted to find his name on the list. For the moment I should think Dr. Walter should remain your President, and after him there is only one man in the country who should be President of the American Institute of Architects, so far as men in New York are concerned. That man has a reputation not only in America, but it goes far beyond it, to England, France, and, in fact, all the adjacent European countries—Mr. Richard M. Hunt, of New York. I must very respectfully decline your nomination.

Secretary Bloor, referring to a private letter handed him by a Mr. Cutler, of Rochester, said that it was in favor of

the present incumbent being replaced by another. Also another letter was received from ex-Secretary George C. Mason, urging that no intimation of slight be put upon "the present father of American architects"—Dr. Walter.

Vice-President Kendall—I suggest that the nominations be referred back to the committee.

Mr. Cutler—I understood that Dr. Walter definitely declined a year ago to be a candidate for re-election at this convention.

Another fellow—I heard him distinctly say last year that he would take it only one year more. He is doubtless too ill now to give the matter any thought.

Mr. W. R. Briggs, of the Nominating Committee—The Committee on Nomination had this in view that Dr. Walter was not a candidate. They did not for a moment think to hurt his feelings, but understood that he declined.

The Secretary read Dr. Walter's words of acceptance a year ago, the closing sentence being, "If I live another year, I will get you to allow me to take a rest."

Mr. Cutler moved that a committee of three transmit to Dr. Walter hearty resolutions expressive of the valuable services rendered by him during the long term of his presidency and of the regard that all felt for him, the occasion of the testimonial being the fact he had absolutely declined re-election to the office he had held so long.

Mr. John Moser—And embodying the fact that we have given him all the honors that he would accept.

Carried unanimously, and the Chair said he would name the committee later.

A letter from Mr. Avery was read by Mr. Bloor positively declining to be made secretary. The subsequent discussion developed the fact that Mr. Avery is ineligible being only an associate member.

Mr. Adler—Has Mr. Hunt exhibited a willingness to accept the position? As Mr. Hunt has not seen fit to attend the convention it might indicate that he would not accept.

Vice-President Kendall—Up to within a few days Mr. Hunt, I understood, had proposed to come, but he was ordered to Washington by the Government in connection with the new naval observatory.

The Secretary—That is what he says in a letter to me.

Mr. Willett—The fact that Mr. Hunt is not here and has not sought the office is rather a recommendation.

The Secretary—I agree with Mr. Willett that the non-attendance of Mr. Hunt may be taken as an indication not that he does not desire the office, but that he felt it a matter of delicacy not to be here when he thought his services might be asked.

Vice-President—I know Mr. Hunt to be as unassuming as he is competent.

Mr. Bloor (replying to another question by Mr. Adler)—Yes; I have every reason to believe he will accept it, and take it as an honor.

Then the nominations were referred back to the committee to be purged of several names of associates, made by the constitution ineligible to office.

Mr. Bell, of the committee on the trustees' report, recommended that its recommendations be taken up *seriatim*. Accepted. Similar action was taken on the Audit Committee's report. Next came the report of the special committee on reports, etc. It favored printed forms for reports from chapters, not limiting reports from the chapter secretaries, however; it favored a continuance of the committee on permanent home; that the report of the committee on uniform contracts be accepted; that all protective work deemed desirable in the interests of the institute be undertaken by the institute within the limit of the present organization; that the committee's report on improvement of Federal architecture be accepted and the committee continued with the addition of M. E. Bell, late Supervising Architect, and one other architect representing the district west of New York.

Mr. Bell, late Supervising Architect, followed with a paper on "The National Building Question."

Thanks having been voted Mr. Bell, and his paper accepted, Mr. W. W. Boyington next entertained the convention, his subject being "Differences between the Methods of Architectural Practice prevalent now and fifty years ago." Half a century ago was an earlier period, he said, than his practical experience as an architect covered. It was, however, in the earlier years of his studies in architecture. There were no schools of technology nor polytechnic institutes then, and there were but very few professors and teachers of architecture. He commenced under Professor Stone, of New York, studying classic architecture. Matters then considered essential were wholly disregarded now. Chicago to-day had more architects than the whole country then, and, excepting electricity, architecture had made greater strides than any other of the arts and sciences, and to-day the American profession could vie with that in any country. Fifty years ago this country knew no style in architecture except classic and gothic, and but very few pure examples of either had been produced, the majority of buildings of the period being plain and built by master builders who usually made their plans on the trestle board, designating with white, red, and blue chalk the timber, slate, and brick entering into the construction. His father was a master builder and used to make his own plans largely in the way indicated. Architectural publications had increased in proportion to the profession, now numbering upward of 3,000 practitioners. Fifty years ago architects were largely supported by contractors. Now owners had found it necessary to deal directly with architects, yet still there were many impecunious persons who did not do so—Philadelphia especially having comparatively few architects. Thirty-four years ago, coming to Chicago, he found the architects in practice

* Abstracts of papers read will be printed in subsequent numbers.

were recently master builders or contractors, and indeed Chicago and the West could hardly be said to require the services of architects, the buildings were so simple. The first architect in Chicago was prevailed on to quit building and confine himself to making plans on being guaranteed \$2 per day, even should the sale of plans bring less. One day he took in \$5 for a plan and was in high feather over the circumstance. The speaker was introduced in the infant city as a young architect from Massachusetts, and was often asked what was the business of an architect. He immediately instituted the practice of charging a percentage on the cost of buildings, the amount to be always collected from the owners. This departure was rather uphill work, but it succeeded, and from that small beginning Chicago could to-day boast of as fine and capable a corps of architects as any city in the Union, and the architect who first commenced the practice of the profession in Chicago was still living and in business, while the speaker's own services had radiated out from gulf to lake and Atlantic to Pacific, and his lot it was to construct the first cab used over a locomotive engine in this or any other country.

Charles H. Ham then read a paper on "Manual Training as Applied to the Building Arts." It was always, he said, the hand that came to the rescue of imagination and speech. From the rude hut to the splendid mansion was a long progression, and it was not achieved by mind alone. It was only in mythology that thought created; in real life things of beauty sprang only from thought and hand combined. The steam-engine of Watt existed in the mind of Hero of Alexandria, but to develop Hero's thought required two thousand years of experiment. It was the hand that quarried each stone, fashioned every timber, made the mortar, drove every nail. The work of the hand was not confined to the grosser departments of art. It traced on paper the builder's initial thought, a thought too subtle and insubstantial for expression in words. It was the mind's faithful coworker, rounding the dome, pointing the spire, and overlaying all with the grandeur whose design was not more largely beautiful than finely wrought. There was more imagination, sentiment, humanity in a locomotive than in the statue of Praxiteles, the painting of Raphael, or the work of Shakespeare. The coeducation of the mind and the hand was a duty to society and the State, and was plainly the road to the solution of the labor problem, as it would dignify labor and result in a fair distribution of the fruits of labor among those contributing to their production. "Thou shalt not build and another inhabit; thou shalt not plant and another eat."

Secretary Bloor—I move that be accepted, with thanks for the very fine and able paper. Carried.

Then the Nominating Committee reported a second time, as follows: President, R. M. Hunt, New York; Secretary, William A. Potter, New York; Treasurer, O. P. Hatfield, New York; Board of Trustees, N. Le Brun, New York; L. T. Scofield, Cleveland; H. M. Congdon, New York; John W. Root, Chicago; Committee on Education, Professor N. Clifford Ricker, Urbana, Ill.; Alfred Stone, Providence; Professor W. R. Ware, New York; J. W. McLaughlin, Cincinnati; Henry Van Brunt, Boston; Committee on Publication, Charles Crapsey, Cincinnati; T. M. Clark, Boston; S. S. Beman, Chicago; George C. Mason, Jr., Newport; Secretary for Foreign correspondence, Arthur Rotch, Boston.

Mr. Adler—If these nominations are now satisfactory to our present Board I move that the nominations be accepted.

Mr. Bell—Will Mr. Potter accept the Secretaryship?

Mr. Bloor—I have promised to beg him to.

Mr. Kendall—And the constitution provides for a vacancy that the present officers shall hold over.

Then by one ballot all the nominees to office were elected.

Henry Lord Gay presented a very eulogistic memorandum on the retiring Secretary, A. J. Bloor, proposing not only thanks, but a pecuniary compensation—conformably with the circular sent out—for his very laborious and acceptable services, and that a salary be given thereafter to the Secretary.

Mr. Bloor, expressing appreciation of the friendly words, disclaimed all official knowledge of the circular referred to.

Mr. Briggs proposed an amendment to the by-laws, to be acted on in due course, doing away with the clause setting forth that associates are not eligible to hold office.

Adjourned for lunch at Krosley's, and subsequently a carriage ride to North Side points of architectural interest, including the North-Western Terra-Cotta Works.

In the evening the institute assembled at the Permanent Exhibit of Building Materials and Appliances. The attractions of the resort were set off by a well-mounted exhibition of illustrations of work executed within the last ten years by practitioners invited by the Western Association of Architects. Very few but Western articles were represented, but the exhibit proved to be very interesting for an hour's inspection.

Subsequent to this, a short evening session was held in the hall of the Permanent Exhibit, and an illustrated paper was read by John Moser, fellow, on "Federal Buildings for Judiciary, Customs and Postal Service." It was very minute and analytical as to the interior features. In external style there should be nothing antiquated, he said, but everything pitched on the modern key. It should have a red stripe down the parts, as it were, to give an official smack to it all. The dress should be no misfit, but a dignified, tailor-made garment. The arms of our Gov-

ernment belonged here as much as on a silver dollar. It should be massive, powerful, leonine. It should show the most careful refinement and the simplest as well as the most ornate forms, and the perfection of its workmanship should challenge attention everywhere. It should look its best in the present, not requiring partial disintegration to make it artistically interesting. Domes and fancy pinnacles were to be excluded, it being a business building and not for parade, and perhaps the square-top roof was best. The Classic style was too sacrificial, the Romanesque too warlike, the Gothic too sacerdotal and spiritual. The ideal Government building, he thought, should have the grace of the French school, the refinement of the Florentine, the strength of the English, and the system of the German.

Adjourned.

The architects, members of the Institute, attending one or more sessions of the convention, were as follows: Edward H. Kendall, New York City; O. P. Hatfield, New York; A. J. Bloor, New York; N. Clifford Ricker, Champaign, Ill.; D. H. Burnham, Chicago; Warren R. Briggs, Bridgeport, Conn.; Edward J. Nickerson, Providence; Henry W. Hill, Chicago; Alfred F. Pashley, Chicago; John J. Deery, Philadelphia; S. S. Beman, Chicago; Fred H. Gough, Utica; William S. Wicke, Buffalo, N. Y.; S. A. Treat, Chicago; Normand S. Patton, Chicago; George A. Frederick, Baltimore; Otis Dockstader, Elmira, N. Y.; George W. Rapp, Cincinnati; James Cutler, Rochester, N. Y.; J. Mason Maury, Louisville, Ky.; C. A. Wallingford, St. Paul, Minn.; Charles Crapsey, Cincinnati; John W. Root, Chicago; L. D. Cleaveland, Chicago; C. M. Bartberger, Pittsburg, Pa.; Eugene H. Taylor, Cedar Rapids, Iowa; Henry Lord Gay, Chicago; Adolph Cluss, Washington; E. L. Walter, Scranton, Pa.; Louis H. Sullivan, Chicago; J. F. Alexander, Lafayette, Ind.; C. H. Brodie, A. R. I. B. A., London, Eng.; C. A. Curtin, Louisville; John Ord, Philadelphia; M. E. Bell, Chicago; W. Bledwyn Powell, Philadelphia; William Aiken, Cincinnati; William C. Smith, Nashville, Tenn.; C. J. Clarke, Louisville, Ky.; William W. Clay, Chicago; Melvin P. Hapgood, Hartford, Conn.; S. V. Shipman, Chicago; William Holabird, Chicago; J. L. Silsbee, Chicago; J. J. Flanders, Chicago; W. L. B. Jenney, Chicago; Albert W. Gibson, Albany, N. Y.; W. A. Otis, Chicago; S. R. Burns, Dayton, O.; D. Adler, Chicago; John Addison, Chicago; August Fiedler, Chicago; John Moser, Washington, D. C.; Levi T. Scofield, Cleveland, O.; A. Smith, Chicago; James W. McLaughlin, Cincinnati; W. R. Brown, Cincinnati; P. B. Wight, Corresponding Member, Chicago; F. L. Charnley, Chicago; W. G. Preston, Boston; James R. Willett, Chicago.

The convention was called to order by a mallet made from the keel of the "Kearsarge."

The Committee on Arrangements consisted of W. L. B. Jenny, E. T. Littell, Henry Lord Gay, and A. J. Bloor. The Chairman of the Reception Committee was S. H. Treat.

The third day's session began with a paper by D. H. Burnham, fellow, on "Suggestions towards the best and speediest methods for harmonizing and utilizing all the architectural societies in the United States, so as to secure the most good for architecture, for the public, and for the profession in America; due regard being had, as concerns means, alike to individual energy and enthusiasm, and to associative experience; and, as concerns ends, alike to local sentiment and to national reputation."

This paper from the start commanded exceptional attention, as it was known in advance to advocate the death of all existing architectural societies and their resurrection into one united whole.

[This paper will be printed in a subsequent issue.]

Mr. Burnham on closing his paper offered the following resolution: "That a committee of five members be appointed, of which the chairman of this convention shall be a member ex-officio, the other four members to be selected by him, to act jointly with one of similar number to be appointed by the Western Association of Architects at their next general meeting, to report as to the best and speediest method of consolidating all the architectural societies of America into one organization, the report to be full regarding form of constitution for local societies and also form of constitution, permanent place of meeting, and proper quarters for the national or representative body. That the Western Association of Architects be and they are hereby cordially invited to unite with us in this work and to appoint a committee as above."

Mr. Bloor—I second the motion. I consider it an able paper and I think that most of the members will agree with its general aim, though I think there are some points we will not agree upon.

John W. Root—I would like to amend so that the general committee have also five members from the Architectural League of New York.

Mr. Burnham—I didn't think that would be advisable, as they are not a national society.

Mr. Bloor (sotto voce)—I don't consider the Western Association a national body.

Mr. Root—The Architectural League is not analogous to any other local architectural society.

Mr. Briggs—That is true. Although the active membership is confined to New York, non-resident members are scattered all through the country.

Mr. Bloor—I was a member of the committee which formed the constitution and by-laws of the Architectural

League of New York. Mr. Burnham is right in saying that legally it is confined to New York. Mr. Root is right in saying that there is an understanding that its benefits should be extended outside of New York if there is any disposition in architects outside of New York to avail themselves of it.

Mr. Root withdrew his amendment.

Mr. Bloor—It was the theme that I suggested to Mr. Burnham to see if we would not unite all the architectural bodies of the country.

Mr. Adler—I would amend that the joint commission constituted by the A. I. A. and the Western Association of Architects shall have power to add to its numbers representatives of other organizations as may see fit to join in the general consolidation of the architectural associations of America.

Mr. Burnham—The work of the committee is solely to get a general scheme to submit to the societies.

Mr. Gibson—Can the committee not be named from those who are members of several associations?

Mr. Adler—As Chairman of the Board of Directors of the Western Association of Architects, I will say the matter has been broached in our board of directors and I believe the entire membership of the board is in favor of an effort at consolidation, and I think they also reflect the wishes of many of the members of the Western Association. There is no doubt that this resolution will be received with favor at the convention of the Western Association which meets next month in Cincinnati. [Applause.] I withdraw my amendment.

The resolution was then adopted *nem. con.*

"Opera Houses" was the subject of the next paper, the writer being J. C. Cady, fellow, of Washington, and the reader L. H. Sullivan, Chicago. An opera house had three requirements—musical, dramatic, and social—and grand opera met the first two. The great expense of grand opera was met, as in Europe by the Governments very largely, so with us by subscribing boxholders among the wealthy and fashionable class, grand opera affording rare opportunity for the display of beauty and toilets. Three considerations must dominate in constructing the building—the stage and accessories, accommodation for a large audience, and special care for boxholders guaranteeing the enterprise. As to the stage it must have large dimensions, like 80x100 feet, and correspondingly deep cellar and high rigging loft. The general audience, occupying a portion of the parquet and tiers above the boxes, they must have spacious, comfortable seats. The exits must be abundant, the building fire-proof, with iron water-tank overhead. Automatic sprinklers were undesirable, as the pipes might burst, destroying the scenery. Regarding accommodations of boxholders, or founders of grand opera, each should have a box, giving seclusion yet allowing display of the occupants. The boxes should accommodate six people, and, to obviate disagreeable possibilities, be similar in style, size, etc. Each box should have a small withdrawing room; for partaking of refreshments, etc.; a long corridor should connect the succession of salons, and a large vestibule and covered driveway accommodate those waiting for carriages that they might be reached with expedition. After constructing such a building in its essentials there would be little money left the architect for aesthetic surplusage in decoration; rather, he must treat the problem with a simple dignity that would not be tiresome as the years went by.

"Prominent Requirements of a Large Library Building" was the subject then discussed by J. L. Smithmeyer, fellow, of Washington. Chief among those requirements, the paper stated, were abundance of solar light, a general provision of artificial light at night, plenty of pure air, a suitable temperature, well-designed protection against the ravages of fire and the deleterious influence of dampness; proper ventilation, convenient interior arrangement, durability of building material, stability of construction. Other considerations also played a most important part. The site should be dry, as great a requisite in a book magazine as in a powder magazine, and proper provision made of the best sanitary arrangements. Nor must the style of architecture be neglected, the artistic combining with the useful to produce the harmonious whole. Foreign models did not meet American requirements, and since we were too young to have our own fixed standards yet, the creative faculty in the individual architect must be called on in a more than ordinary degree. No infallible type could be set up for all locations and circumstances. Most of the large European library buildings sprang into existence, especially the older ones, under conditions differing widely from each other and from the age. Princes and ecclesiastical dignitaries had given palaces and great buildings, requiring much change, and much could be learned by a study of the various novel devices often resorted to. In spite of variations, these buildings could be readily classified into two types—the first the compartment, accommodating at once the books and the readers, and the second separating the two. Small libraries naturally belonged to the first type, but it had its limits, since libraries grew like people and nations. Library construction, as a rule, should proceed on the progressive plan. Dust was the *bête noir* of books, and unless the ventilation movements were downward the dust would rise and destroy the books in the upper tiers. Rapidly changing temperature injured books, as did excessive humidity, and the odor of books and their binding was not healthful, and could not be made more so in one crowded, common compartment. The better plan of separate reading-rooms was being increasingly adopted in the old world and with us, and very widely. The congenial library building illustrated the progressive plan, and its present flexible capa-

city for 2,500,000 books could be extended to accommodate 8,500,000 without enlarging the building. In conclusion, the writer hoped that in endeavoring to be brief he had not been obscure.

Mr. Frederick, of Baltimore, then personally read an essay on the "Dining-Room, its Adornment and Decoration." This apartment was the sanctuary of social intercourse and hospitality, and the table its altar. Direct sunlight should be avoided, especially in summer. Never permit the light to come from more than two sides of the room, and these should be opposite, if possible. Artificial light should come from a chandelier directly overhead, or candelabra on the table; no other light should be permitted unless actually required for the side table. The chandelier must be sufficiently elevated nor to be in the range of vision and yet not so high as to cause unpleasant shadows on the faces of guests. The wall decoration was but the background, and blue being avoided, warm oddish tints were preferable as a foil for silver and other metals and glassware. Oak must always remain the favorite for dining-room furniture. Wainscoting, while generally to be used, should not be too high; an economical substitute was a small chair-rail. Ceiling-panels were always in order, and should be molded in pleasing forms, not too heavy. The walls could be ornamented effectively in diaper, in low-relief plastic. An open fire-place was recommended. Pictures hung upon the wall should have a color background blending into a single tone. Without absolutely prohibiting picture ornamentations, such as sometimes formed a fixed part of the decoration, they must be carefully limited to harmonious themes, as the cycle of the month, the annual sequence of the seasons, agriculture, the sea and its fishes, the subjects always pleasing and cheerful, as taught by examples in Pompeii. Designs and pictures in the ceiling must follow the same rule as for the walls. Portraits of family ancestors were well placed in the dining-room, silent witnesses of the prosperity of their successors. The dining-room, too, was the proper sphere for the display of fine china and silverware, having appropriate admission in the wall and mantel display and sideboard. The carpet or rug on the floor, like the ceiling, should not especially fix the eye, all figures being out of place under foot, and the walls the paramount place for decoration. Carving, excessive ornament and gilding were totally out of place. The table and its toothsome garniture must be left to the hospitable host and hostess and the efficacy of their cook, who in all cases, let it be devotedly hoped, might be a good one.

The chair announced several committees as follows: To express the sense of the institute on the views of Dr. Walter, Messrs. McLaughlin, Smith, and Cutler; to draw up a blank for chapter reports, Messrs. Ricker, Preston, and Frederick; to confer with Western Association of Architects and Master Builders, Messrs. Hatfield, New York; James H. Windemeyer, Philadelphia; Stone, of Providence.

Mr. Gay moved that a committee be appointed, one member from each large city, to indemnify Mr. Bloor for expenses as secretary of the institute. Carried; the chairman Messrs. Holly, Gay, Murdock, Crapsey, Lizius, Van Brunt, Chandler, Stone, Laver, Isaacs, Smithmeyer.

The report of the committee on the directors' report was submitted. Its recommendation of large annual dues was referred to the committee on the proposed consolidation of architectural societies. Chapter secretaries were directed to send in their reports one month before convention. Incidentally, a fellow remarked that the Cincinnati Chapter ought to be reorganized, and Mr. Crapsey, of Cincinnati, replied, "Yes; we will reorganize it out of existence." The committee on permanent home was continued and its three members will be increased to five. The report of the committee on uniform contracts was adopted.

Then quite an interesting debate sprang up, on the

recommendation to continue and add one Western member to the committee on improvement of Federal architecture. Mr. Adler wanted the committee empowered to make such modifications in the draft of the bill as might be deemed expedient to secure its passage. As one of those who went to Washington in behalf of the measure, he came to the conclusion it might be necessary to make modifications—some trivial, some of importance—to render the bill more palatable to those who would have to enact it. Treasurer Hatfield suggested that the Western Association of Architects increase their committee to the same number as the American Institute.

Mr. Burnham—I don't see the use of such a committee. I believe that it cannot accomplish more than the committee previously appointed, and whose efforts resulted in absolutely nothing. To carry out such a reform will require an organization with a great many members in a great many States. There will have to be influences brought to bear to win the Congressmen and Senators, bombarding them with shot from the press, as one of themselves said to me—a high-toned gentleman—and he added that if a Congressman is not compelled by party influence or personal interest he will refuse to act in such cases. I would move as an amendment that the committee be discharged.

Mr. Bloor—I think that nothing will be gained by Mr. Burnham's motion being carried out and that a good deal would be lost. I think there ought to be a committee not larger than five from each society, and that they should be appointed with power—the committee is already appointed with power on the side of the Institute—and that it avail itself of every means at its command to attain its ends. I have received advice from Mr. Hewitt to pursue methods somewhat different from those that Mr. Burnham has been advised to pursue.

Mr. Burnham—I think that Mr. Hewitt's letter, read early in this convention, sustains my position.

Mr. Bloor—Mr. Hewitt does not say that the committee cannot accomplish anything. Mr. Hewitt says it is necessary to enlist one member of Congress; that our only plan is to interest very much such Congressman, make him the father of the bill and make him carry it out. I have advice from other quarters to work through the Secretary of the Treasury and through the incumbent of the office of Supervising Architect of the Treasury. I believe the advice given in each case is good and that we should follow it, and I move that the committee be continued with the modification recommended by this reference committee—namely, that it be added to and continued with power and do the best it can in conjunction with the joint committee appointed by the Western Association.

Mr. Adler—I move that the joint committee endeavor to avail itself of the ideas expressed by Mr. Burnham.

Mr. Bloor—My own personal opinion is that we must manufacture public opinion through the press.

Mr. Burnham—I don't want the bill tossed about in Washington so that men will become disgusted with the thing. With a strong organization, with a thoroughly consolidated organization where the committee has a work with men from every State and they can be sent out to do hard work, the reform will be started directly. Then I think we must have somebody in Washington to see that it is done. I don't mean lobby, although that is what it amounts to. It should be honest work, open and above board; but it is necessary that some one should be there in our interest to see that it is brought up and forced to a passage. Good bills which all acknowledge should become laws are only passed by Congress when there is somebody there who is particularly determined that they shall be passed. That means that we must employ somebody or that some member of this association should go there and stay until the work is done. I would rather not see demands made which I know will be abortive before

they are started. When the next demand is made I would like to see it carried right through to success. But that means that we must do a great deal of thinking, a great deal of planning for it.

Mr. Adler—It is not the first time that good measures have been held in abeyance. If it is really our desire to secure the passage of this bill, we must not be discouraged with a repulse. I think the abandonment of this committee would be considered by the profession as an acknowledgment of defeat; that we recognize the fact that we have been defeated; that it is all no earthly use to endeavor to push the work we have in hand. We should undoubtedly maintain this or some other committee whose duty it is, not simply to go to Washington and interview a few Congressmen there, but to endeavor to make use of every possible means, through agitation, through the press, through interviews with enough members of Congress, through every auxiliary at command to secure the end for the attainment of which we are striving. It will be the duty of the committee to set in motion the very machinery which Mr. Burnham thinks so desirable. I think it easiest to maintain the committee.

Mr. Burnham's amendment for discharging the committee was then rejected and the committee continued.

The other recommendations in the directors' report were then adopted.

Adjourned for lunch in the ante-room.

On reassembling the convention sat for over an hour with closed doors on a case of discipline and the matter was referred to the Board of Directors. Then followed the usual votes of thanks all around, and Mr. L. D. Cleveland, who was in the chair, declared the convention adjourned.

ARMORY ROOF, BUFFALO, N. Y.

The roof of the Seventy-fourth Regiment Armory Building, Buffalo, N. Y., Mr. George J. Metzger, architect, was built and erected by the Niagara Bridge Company.

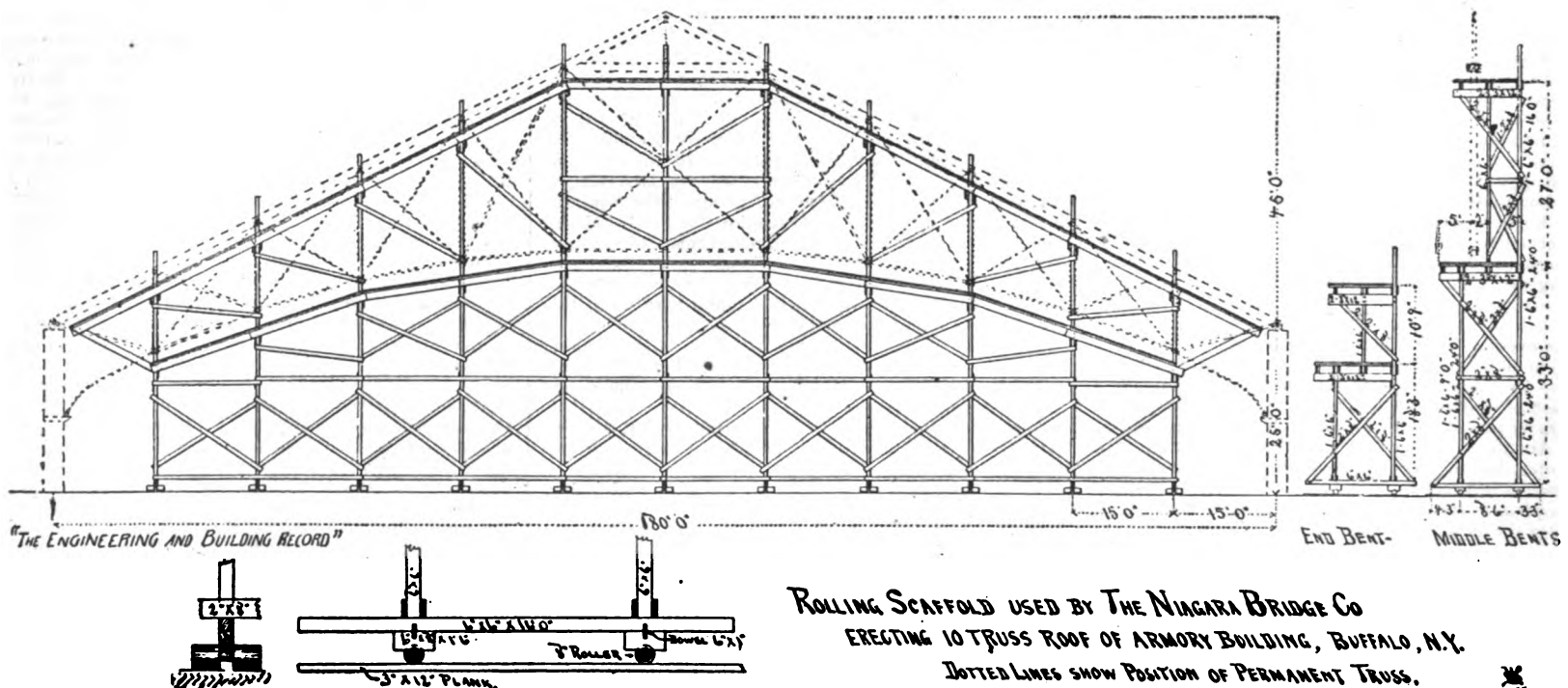
It consists of 10 trusses, 180 feet span centre to centre of end pins, spaced 25 feet 3 3/4 inches centres, with top chord lateral bracing in alternate panels.

The metal weight of trusses is 120 tons, and there are 128,000 feet, B.M., of Norway pine in trusses and purlins.

All tension members are round, and square rods or die-forged eye-bars (the latter made by Union Bridge Co.) of high-test double-refined iron; connections carefully bored to gauge.

The trusses are bolted to the walls and have expansion rollers at one end to provide for the 1/4-inch movement that the extremes of temperature in this locality causes.

The trusses in position are very stiff, and the pleasing effect is improved by the pair of curved eye-bars that continue the arch-like line of lower chord from the foot of the first vertical post to a bracket half-way down the face of the wall. These bars are precluded from exerting any strain during temperature, oscillating by the slotted hole connection at the foot. An interesting feature of the construction of this roof was its very rapid and economical erection from a movable scaffold carrying upper and lower platforms, as shown in Fig. 2, that was mounted on rollers and transferred from one truss and adjusted in readiness for the succeeding one in half an hour. It was originally



attempted to lay the corrugated-iron roofing directly upon the purlins, which were spaced for that purpose, but this was found undesirable, and a board sheathing was laid as for shingles. The fastenings of the corrugated sheets are still troublesome and loosened by temperature changes.

The armory walls are brick, buttressed at each truss, seat and foundations carried down to solid rock, and as the total cost of building, excepting roof-sheathing boards, was only \$50,000, the roof is of interest as well for its cheapness as for a neat and light example of an unusually long span combination roof-truss.

EADS' LAST WORK.

ABOUT February 1, 1887, Mr. Eads, then in New York, sent for Mr. H. W. Brinckerhoff, now of the editorial staff of THE ENGINEERING AND BUILDING RECORD, and desired him to revise the designs for the ship-lifting appliances of the Tehuantepec Ship Railway which he had made for Mr. Eads nearly four years before. Giving him some verbal instructions and a few rough pencil sketches, reduced about one-half in the accompanying facsimiles, he sailed almost immediately for the Bahamas, hoping there to recover his health, never robust, and then much impaired by his incessant labors in behalf of the Ship Railway. Before leaving he desired that tracings should be sent him in about a fortnight showing the progress made on the revised plans, and it is to the tracings of these plans that allusion is made in the following letter—perhaps the last he ever wrote, certainly the last of a professional nature, as his death occurred on the 8th of March following. It is interesting to note the progress of his thought in this letter, each suggestion showing a distinct advance, until a final and satisfactory conclusion is reached.

The sketches, though hastily made by an invalid's hand, give evidence of careful thought and much attention to detail. They do not correspond very closely with the letter, several changes in the size, number and arrangement of the rams having been made meanwhile. It must be remembered, also, that the sketches show mainly the ship-lifting platform, while the letter relates almost exclusively to the counterbalancing tank on shore, both tank and platform resting on rams of equal aggregate displacement, and so connected that as the platform rises the tank descends, and *vice-versa*.

The interest of these documents, apart from the distinguished character of their author, lies in their relation to the cardinal feature of the most daring and gigantic project of modern times.

ROYAL VICTORIA HOTEL,
NASSAU, N. P., BAHAMAS, February 25, 1887.

DEAR MR. BRINCKERHOFF:

I am much pleased with the plans you sent me so far. Make the rams 30 inches in diameter, the whole 32 of them. This will enable us to pack them with leather, which is much more reliable for 1,500 pounds than hemp is for 600, I think.

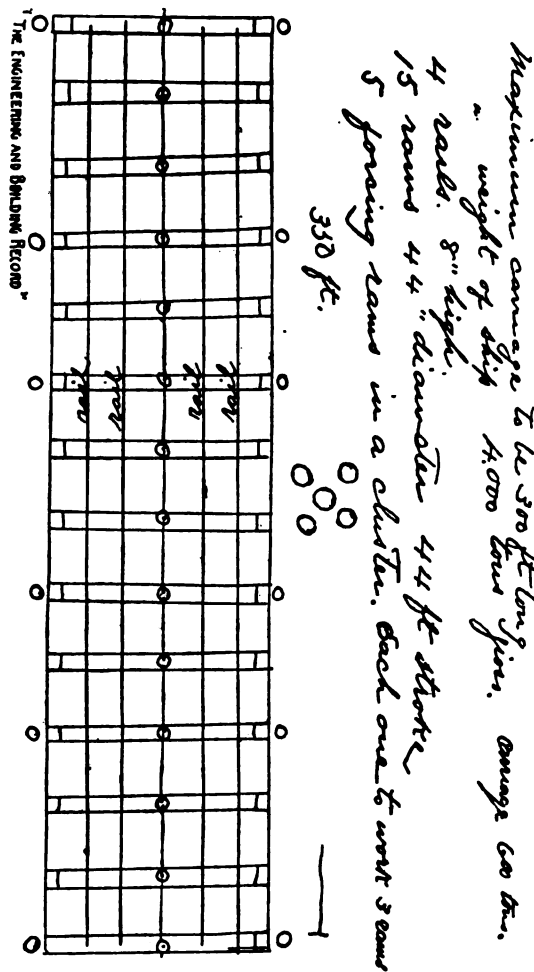
The 16 rams on shore should be put in a circular pit 60 feet diameter, lined with a concrete wall averaging 4 feet thick, started on a bed of concrete 80 feet in diameter and 10 feet thick, commenced 40 feet below low-water mark. On this bed cast-iron bed-plates well ribbed must be bedded for the cylinders to stand on. These 16 rams will support an iron tank capable of holding enough water to raise the platform, 1,200 tons; the ship, 4,000 tons; the carriage, 600 tons; total, 5,800 tons. The two sets of rams will balance each other in weight.

This tank had better be circular and made of $\frac{3}{8}$ -inch plates. It should rest on a cast-iron plunger head, into which the plungers should be accurately socketed about one foot deep. As this head and the empty tank will weigh less than the platform, the latter will always raise the tank and its plungers and head. When the tank is filled with water it must hold enough to bring up the ship, platform, and carriage.

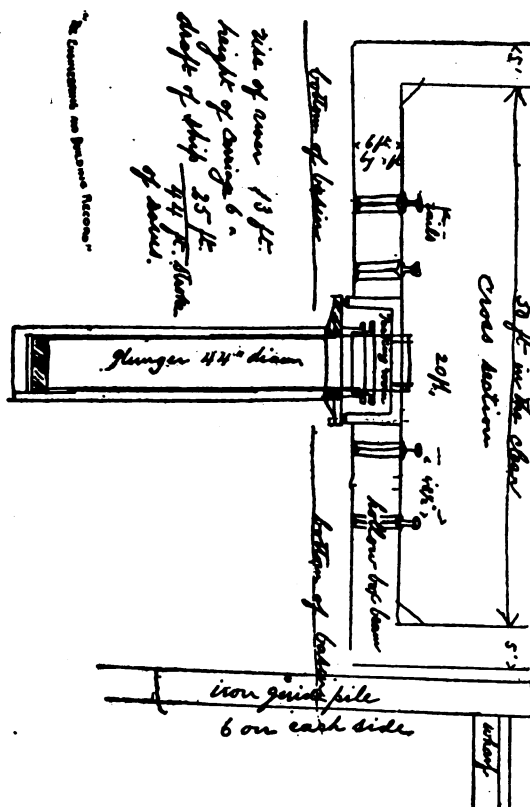
I think we can get head enough in the Coatzacoalcos River within fifty miles to fill this tank rapidly with a flume six feet square, but we will provide sufficient pumping power to fill it in half an hour, and not depend on the former until we know that we can get it.

I suppose sixty feet diameter by fifty feet high for the tank will be sufficient. It must be guided in its ascent, and it should be so arranged that when empty it can be lowered down on rails or slides and moved off so as to give

convenient access to the rams and plungers. A reservoir must be provided near by into which its contents can flow rapidly through a telescopic pipe or pipes, and from which our pumps will return it to raise the platform. On the railway provided for the tank there should be a moving or travelling crane to handle the rams, etc.



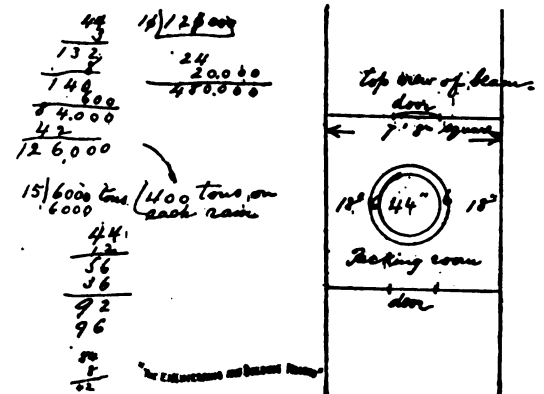
Of course, this plan admits of many modifications, and I wish you to make several which will suggest themselves to you and find such one as will admit of the simplest details and most economic construction, keeping the data from which you estimate approximately the cost of each,



and putting it in such convenient shape as you can for future reference. For instance, you may find it cheaper and better to sink down four iron cylinders as casings in which to place four rams each, instead of putting all sixteen in the concrete chamber described. Again, it may

be better to have the rams stand higher above ground and pass through the tank, each through a separate cylindrical opening in the tank in which each ram-cylinder would act as a guide for the tank. Or, four such cylinders (rams) could be clustered together in one such opening through the tank (four openings in all). The tank could be suspended by cross-heads on each plunger and would be so shallow as to expose the plunger-heads above it when down, so as to give easy access to any one ram, and thus make it unnecessary to ever remove the tank. The cylinders or their rams if leaking would be packed on the top of the tank or lifted out of their casings up through the tank for repairs.

You may find it best to shorten the stroke and increase the diameters of these shore rams to save pumping the water so high in the tank, in which case the capacity of the tank must be increased. I want leather packing, and this would limit their diameter to probably thirty-six inches. It may be better to double the number and give



them only half stroke, making each pair of the thirty-two fill one cylinder under the platform. This would greatly reduce the height to which the water would have to be pumped up, but would require twice as much tank area to give the necessary pressure.

I do not wish to confine you rigidly to either one of these modifications. Make enough sketches to determine which is best and follow that one out in all its details.

Show this letter to Mr. Corthell and he may be able to advise you when in a dilemma about the plan.

Yours sincerely, JAMES B. EADS.

My health is rapidly improving.

THE NEW CHICAGO WATER TUNNEL.

Abstract of specifications for the construction of a water tunnel eight feet in diameter, from a point on the Lake Park in Chicago to be built in an easterly direction under the bed of Lake Michigan, to a distance of about four miles.

THE Lake Park shaft may be built, at the option of the contractor, either by timbering the excavation to the bottom before commencing the masonry, or by building the upper portion on an iron shoe, to be sunk by excavating the earth within to the required depth. In either case the shaft must be lined with brick masonry not less than sixteen inches thick.

There shall be one shaft at the end of the tunnel and one shaft intermediate to hasten the completion of the work. These shafts shall be protected by suitable cribs; the method of construction of these cribs will be left to the contractor, subject to the approval of the City Engineer, but the contractor must be responsible for their safety, and must maintain them during the progress of the work. The interior well of the cribs must be kept free from water at all times, and he must also remove them and clear away all remains and rubbish after the work is completed.

The shafts shall be cast iron, ten feet in diameter, and the metal $2\frac{1}{4}$ inches thick. The upper end of the inlet cylinder shall be capped with a bell-mouthed casting, covered with a cast-iron perforated plate, strongly ribbed. After the crib around the bell-mouth inlet has been removed the bottom of the lake around the casting shall be covered with a concrete of one part best English Portland cement, two parts sand, and four parts broken stone.

The clear width of the tunnel inside shall be eight feet, and the clear height eight feet and two inches; the top and bottom arches shall be semi-circles; the tunnel shall

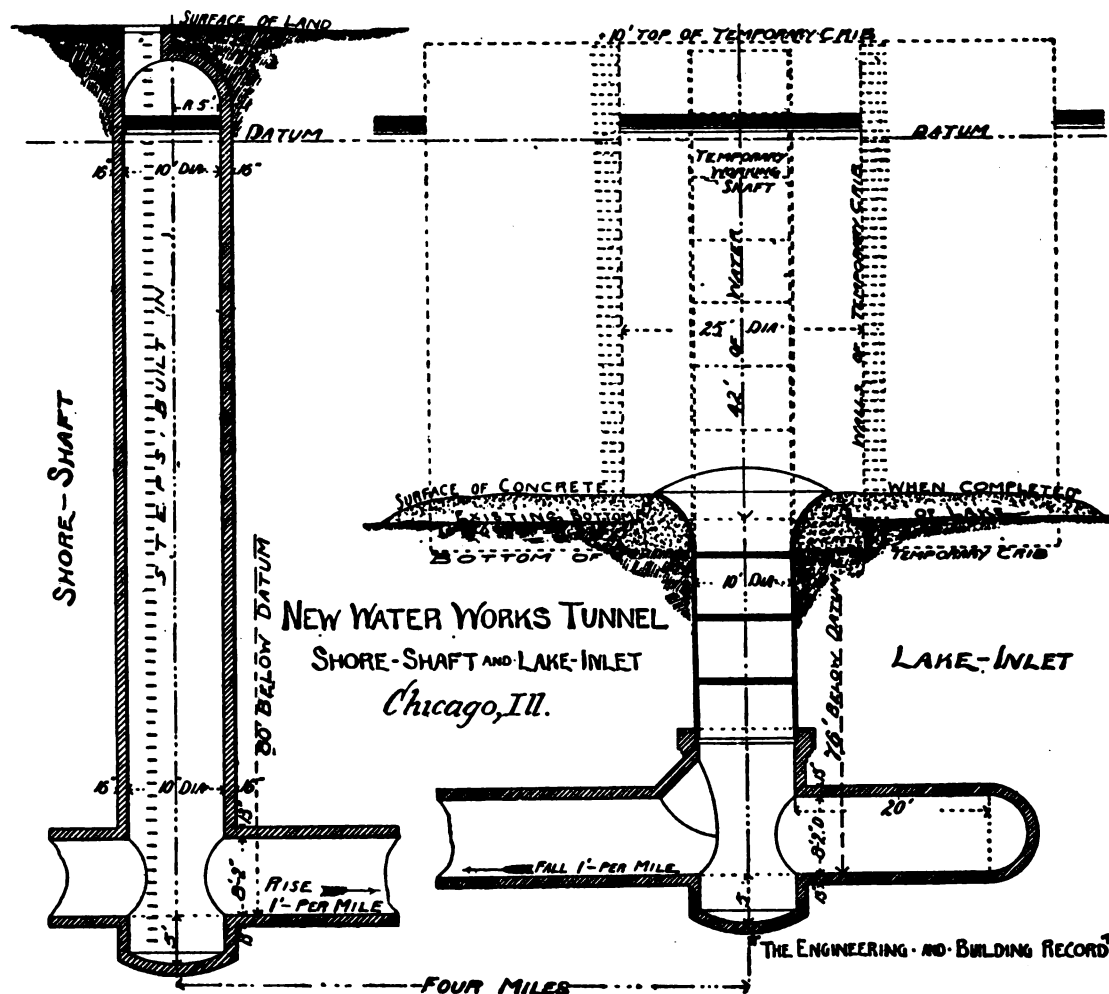
be lined with brick masonry thirteen inches thick. The ground through which the tunnel proper is to be built is believed to be firm clay, with pockets of sand or gravel and water, and occasional boulders, with rock on and near the shore. From the lake shafts the contractor must remove all excavated material to such point as shall be designated, not exceeding one mile from any shaft.

The cement used in this work shall be equal to the best of Black Ball Brand of Utica cement. Where the tunnel is in rock the brick lining may be reduced to one ring of brick.

The Commissioner of Public Works reserves the right to end the tunnel at two and one-half miles from shore, or to extend it to the full length of four miles, as he may elect.

If the tunnel is to end at the first lake shaft, two and one-half miles from shore, the whole of the work shall be finished and completed ready for use within 42 months after signing the contract.

If the Commissioner of Public Works elects to extend the tunnel to four miles, this part of the work must progress at the rate of not less than 1,800 lineal feet of tunnel per year from each working face.



Bids will also be considered for an iron tunnel. The metal shall not be less than $1\frac{1}{2}$ inches thick. This shall be lined with bricks or other material equally good. The top of the tunnel at a distance of four miles from shore shall be not less than 50 feet below city datum and at the shore line not less than 54 feet below city datum.

Proposals for the above work will be received until 11 A. M., Monday, November 7, 1887, by George B. Swift, Commissioner of Public Works, Chicago, Ill. Proposals must be made out on blanks furnished by the Commissioner, and accompanied by a deposit of \$50,000.

The accompanying illustrations show only the shore shaft and lake inlet. The construction of the intermediate shaft is very much the same as that of the lake inlet, except that depth of water is but 40 feet and that bottom of tunnel is 78 feet below datum. The crib, temporary working shaft, and sump are the same, the strainer of course being omitted. On completion the sump and so much of the working shaft as cannot be removed are to be filled with brick and concrete, leaving only the bore of the tunnel.

THE EFFECT OF TEMPERATURE UPON STRUCTURAL IRON AND STEEL.

BY JOSEPH RAMSEY, SR.

STYFFE, Fairbairn, Kirkaldy, Webster, the United States Government Commission, the Railroad Commissioners of Massachusetts, and others, all hold that the effect of low temperature upon iron is very slight, and that it does not tend to produce a brittle condition. Sandberg is the only one who claims that low temperatures have any pronounced effect in producing brittleness—that is, he is the only one among the recognized authorities; but if you have ever been out in the woods on a cold, frosty morning you may have noticed that the axeman warms his axe before beginning work; ask him why he does so: he will reply, "to take the frost out."

Watch the trackman on a cold morning. He is very careful not to strike his cold-chisel too hard, and neither does he cut so deeply into the rail, before dropping it to break it, as he does in warm weather. Ask him why: he will say, "the chisel and rail are full of frost, and will break more easily than in warm weather." The same thing will be noticed with the men who are unloading steel rails, or

usually. On the contrary, I believe it is increased slightly due to the hardening effect of the low temperature, just as tempering and hardening of steel or iron increases the ultimate tensile strength. In preparing for our tests I stated my belief as above, and I found it supported by the tests for tensile strength in the testing-machine. When we come, however, to examine into the strength of iron to resist sudden shock or impact when it is exposed to low temperature, we obtain surprising results, such as seem to call for more thorough and exhaustive tests than have heretofore been made.

The tests made for tensile strength and elasticity showed that there was no decrease in either strength or elasticity under gradual stress; if anything, there was an increase in both. The character of the fractures showed that the low temperature still caused crystalline fractures. In all the tests below 10 degrees Fah. there were from 10 to 15 per cent. crystals, while above 10 degrees temperature every fracture was 100 per cent. fibrous.

The tests by impact were made by a drop weight falling upon a pin, two inches in diameter, which rested over the groove cut in test piece.

I believe that at 15 to 20 degrees temperature the resistance to impact is not more than 25 to 30 per cent. and that for temperature as low as 0 to 10 degrees not more than 10 to 15 per cent. of the resistance at 70 degrees; and at such low temperature as 20 degrees Fah. it is nearly in the condition, as regards brittleness, of cast iron.

During my investigation of this question, Mr. Hunt gave me an account of the breakage of a 12-inch channel beam during the erection of a large highway bridge in the North-west, by it falling a distance of 10 feet and striking a post, the 12-inch channel breaking short off with 80 per cent. crystalline. Mr. Hunt was called on to make an inspection of the beam, and, as the temperature at the time of the breakage was zero degrees, he thought it a good opportunity to test the question of effect of temperature. He had inspected the iron at the mills and knew it to be good ductile iron. Specimen pieces were cut out adjoining the break, and two taken into a shop and warmed up to 70 degrees. In the bending test the iron closed on itself, and the nicked bending test gave 100 per cent. fibrous; the other two specimens were placed outside with temperature of zero degrees, and after being cooled down to that temperature were tested, and both gave 100 per cent. crystalline.

The following questions are suggested to me by the result of my tests, and I think a discussion based upon them will bring out all there is in the matter generally:

First—Should a temperature be prescribed in specifications at which the nicked bending test for texture shall be made, or at which the iron should show good fibrous iron?

Second—Is the present method of testing iron for ultimate strength, elastic limit, and elongation calculated to secure the best iron for bridge-work?

Third—Should not an impact test by drop weight be added to the tests?

Fourth—Is it safe to run trains over iron bridges at high speed when the temperature is low, say 15 above, and if not, what should be the maximum speed at such temperature?

I wish to acknowledge and give credit to Mr. A. E. Hunt for the aid and assistance given me in these tests, also services of Mr. F. Beresford, C. E., of Cincinnati.

[The paper brought out a discussion by Messrs. Becker, Barnes, Hibbard, Hunt, Frank, Hallsted, and Osborn. The "Question Box" was opened for the first time and bids fair to be of great interest. The discussion of Mr. Ramsey's paper will be continued at the next meeting. President Dempster occupied the chair.]

NEWPORT'S SEWER SYSTEM.

DOUBTS have existed in the minds of certain Newport people as to the level of Newport's main sewer. Next month the taxpayers will vote on the expenditure of \$100,000 for the completion of the sewer system, and as a wise preliminary the Committee on Streets and Highways have invited Colonel George E. Waring, Jr., Professor Furman Rogers, and Mr. Charles E. Hammett to examine and report on this disputed point.

ERRATUM.

WILLIAM R. BILLINGS, C. E., requests us to say that in article on "Some Details of Water-Works Construction," No. III., on page 583, 42d line from top of second column, the sentence should read, "the worst cases that have been," etc., instead of the *most* cases, etc.

wheels and axles: they are more careful to let them down easily in cold than they are in warm weather.

You may say, but that is only a popular fallacy. It may be so, but these men have had some experience which has led them to this opinion, and I am afraid that there is more truth than fallacy in their claim that "frost in the iron makes it brittle."

During the past winter I wrote to a number of eminent bridge engineers and inspectors, submitting these questions:

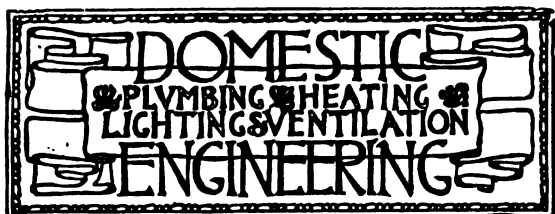
First—Do you prescribe any temperature for nicked and bending tests?

Second—Does temperature affect the texture of iron; that is, will iron be more crystalline at low than at high temperature?

All the replies received were unanimously in the negative, and I concluded to make some tests.

I made a large number of nicking and bending tests by hammer (as generally required by specification), and the fractures obtained invariably were largely crystalline under low temperature and fibrous at high temperature.

As regards the effect of temperature upon the tensile strength of iron, I do not believe that low temperatures reduce the ultimate strength, when the load is applied grad-



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. IV.*

(Continued from page 585.)

THE BOILERS.

THE 14-inch steam-main is composed of cast-iron flange-tees to receive each boiler branch, and the spaces between filled up with the kalamein pipe manufactured by the National Tube-Works Co. This pipe is comparatively a new article of manufacture, and is claimed to give protection against the corroding influence of salt, the protective agent being known as kalamein alloy. It is tested to 150 pounds per square inch of surface. The flanges are fastened into place by an expander.

Figure 3 also gives a side view of the boiler-setting. It will be noticed that the ash-pit is much lower than the floor-level. This was done for the purpose of making a water-pit of six inches depth and over, enabling the fireman to make a day's run without cleaning and still have as large an ash-pit area as ordinarily kept. The space between the bottom of the combustion-chamber and the bottom of the boiler is two feet, or just coincident with the height of the grate-bars.

The back connection, arched as shown at E, sustains the brick-work without the aid of metal supports that are apt to burn out. The space between the sides of the boiler and the brick-work ends three inches below the water-line.

The boilers are covered over with specially made fire-proof blocking.

The walls are built on either side of each boiler about sixteen inches higher than the top of the boiler, then wrought-iron beams of T-section inverted laid across from wall to wall. The blocks of material, 4x13x20-inches, rest on the projecting lips of the inverted T-irons. The bottom side of this layer of blocks is within one inch of the boiler at the nearest point. In addition to this another layer is laid eight inches higher than the first, forming an 8-inch air-space between the two layers beside the air-space formed immediately on top of the boiler by means of the first layer; in other words, making *two* air-spaces above the boiler instead of the usual single air-space. The blocks of fire-proof material were specially made for the purpose.

The boilers are built in continuous brick-work, with no passageway between except air-tunnels running from front to back coincident with the position of the columns of the building which occur between each pair of boilers. These are encircled with brick-work, particular attention being given to having large air-spaces between that connect at their bottom ends with the air-tunnels mentioned.

Air-spaces are formed in the walls where available, and pieces of pipe left in the outer walls to carry off the moisture while the brick-work is drying out. The space from the bottom of the boiler to the top of the grate-bars is two feet. The bridge-wall, twenty-four inches thick, is built square across and measures ten inches to boiler at centre. It is built of ordinary fire-brick to within a few inches of the top and coped with large "pier" brick for stability. The width of the back connection is twenty inches.

SMOKE-STACK.

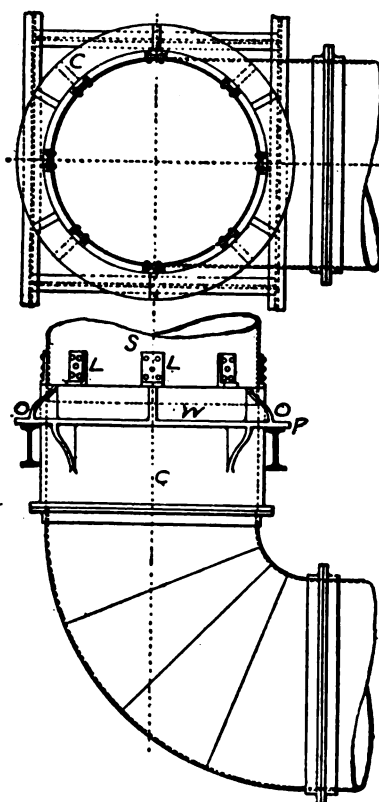
The smoke-stack is made of plate steel in sections ten feet long; the diameter is six feet, and height 170 feet above the sidewalk. The method of joining the sections is by circular castings of angle-iron pattern riveted to each end of each section and bolted together in the rough. The five bottom sections are $\frac{1}{2}$ -inch thick, the next five $\frac{3}{8}$ -inch, and the upper seven sections $\frac{1}{4}$ -inch thick. A ring of wrought iron 3x $\frac{1}{2}$ -inch is riveted around the top for appearance and strength. The weight of the stack is upheld by a base casting of special construction designed by the superintending engineer and shown in Fig. 4.

C is a cylinder of cast iron two inches thick and thirty-

*No. I. of these articles, containing the first installment of Sketches of Plumbing, appeared in our issue of October 8; No. II., General Description of Building and Plant, October 15; No. III., Details of Pumps and Boilers, October 22.

six deep, large enough to take in the bottom section of the stack S. A flange, P, stiffened by brackets, W, extends around the cylinder twelve inches from the top; the flange rests upon 15-inch I-beams at four points, as seen in Fig. 4. Riveted on the stack, six inches from the bottom, are eight strong wrought-iron lugs or feet which rest directly upon the upper rim of the cylindrical casting; thus the whole weight of the stack is borne and transmitted from lugs to castings, thence to I-beams, which are made long enough to rest on the adjoining walls. The stack is kept vertical in the shaft or well provided for it by two 6-inch I-beams running east and west at alternate joints and north and south at those intervening.

The relative position of stack to battery of boilers is at the back and to one end. The connection between boiler and stack consists of a suspended flue of rectangular shape which passes overhead along the back of the boilers of increasing area as it nears the stack. This main flue receives the smoke of each pair of boilers by means of smaller flues running along the top of the boiler brick-work from front to back, the same being in each case a prolongation of the ordinary breeching. Three tight-fitting hinged doors, opening downwardly, are provided on the under side of the main flue for purposes of entry. The rectangular shape gradually comes to a round ending in the large 6-foot elbow shown in Fig. 4, which in turn is bolted to a flange cast on the lower end of the base casting.



SUPPORT OF SMOKE STACK

FIG. 4.

A damper is placed in the breeching immediately over each furnace-door to shut off each pair of boilers when necessary, and in addition a large steam-regulated damper is placed in the main flue immediately behind the large elbow. Where the smaller flues enter the main flue a deflecting plate directs the flow of the gases toward the chimney. The arrangement works well.

BOILER-FRONT.

The boilers are fitted throughout with Ashcroft doors and grate-bars. These grates have been in use in the old part of the building for nine years, and have given good satisfaction. The bars are made of rolled steel cut into equal lengths suitable for various sized furnaces. The cross-section of each bar is that of a triangle with the angles rounded off and the sides slightly curving between the points. They are not connected to each other by a rocking attachment, but pass separately through holes in the boiler-front immediately below the dead-plate, and are made long enough to reach from the front side of the bridge-wall to a point four inches beyond the boiler-fronts, enabling the fireman to grasp each bar with a suitable wrench, and rocking it much or little or revolving clear around if thought necessary.

The bars are borne by bearers set about eighteen inches apart and scalloped on the top side to suit the pitch of the

bars and keep them in place when shaken or revolved. The revolving of the bars grinds out the ashes from the bottom of the fire, leaving it light upon the grate and in condition to permit the air to pass into the interstices of the fuel, avoiding the necessity of using a slice-bar with the anthracite coal in use. By this arrangement the engineer says all parts of the furnace are equally cared for, the remotest corners getting the same attention as the nearest. The intended air-space is well preserved, as the bars can be turned upside down as often as the fireman chooses, a feature which permits of constantly presenting different faces of the bar to the heat.

The approach of the air to the spaces between, it is claimed, is greatly facilitated, as is also the descent of the ashes. By turning each alternate bar with the point up while the others are turned down a much larger air-space is secured than with the points all down as in regular use.

The coal used in the building is "grate size."

The furnace-door is hinged upon the furnace front in the usual way, and, when necessary—as in firing—may be thrown wide open so as to expose the full size of the opening into the furnace; but as regards other purposes it may remain closed. A sectional elevation of this furnace-door was shown in Fig. 3. A rectangular central part of the door A, nearly corresponding with the fire-door opening is cast separately and hung upon horizontal pivots. It is so nearly balanced as to remain in any desired position, the friction on the trunnions being enough to hold it.

The pivoted portion of the door is made double—that is, with an outer and inner wall held to each other at the sides, but having a narrow slit B at the top open to the atmosphere, and a wide slit C at the bottom opening to the furnace, forming a passage through which the air to the furnace enters if desired. The air in passing downward between the inner and outer plate or wall is heated considerably as it comes in direct contact with the plates. The inner plate is corrugated, and, by radiation, transmits much of its heat to the outer plate.

The furnace-door usually does not require to be opened except for firing. In the manipulating of the fire, as by the introduction of a poker to break up the congealed mass which accompanies the burning of soft coal, the furnace-doors do not require to be opened. Neither does the pivoted part of the door to a greater extent than sufficient to introduce the poker under it, while at the same time the fireman is enabled with little inconvenience from the heat to examine all parts of the fire and note where it requires replenishing. This he can do by swinging the top of the pivoted door outward. The arrangement admits of regulating the amount of air needed admitted above the fire for burning various kinds of coal.

PASSENGER ELEVATORS.

The building is supplied with ten hydraulic passenger elevators for public use, built by McAdams & Cartright, 57 Elm Street, New York.

They are situated in groups of two in five separate wells or shafts. Nos. 1 and 2 are placed in, and open directly off, the Nassau Street entrance; four are placed in the entrance hall leading from Pine Street, two on each side of the hall, numbered 3, 4, 5, and 6; four are placed on the opposite side of the main corridor in a recess facing the Pine Street entrance, numbered 7, 8, 9, and 10; nine operate from the basement or ground floor to the eighth story, a distance of 135 feet; one has an additional fifteen feet of car travel, and operates from the cellar to top floor, a distance of 150 feet.

WATER-SUPPLY.

The water-circulating apparatus for these elevators consists of the two large tanks, P P in cellar plan, and the three duplex-pumps B B B, with their connections, in the cellar, and fire-pressure water-tanks placed on top of the building above the highest point of car travel. The same water is used over and over.

The water-tanks shown at P P (cellar plan) are open on top; their surface area is 12'x11'x11'6". They have a united capacity of 15,000 gallons. A clear space is left under them for access to joints, etc. They are made of $\frac{1}{8}$ -inch iron.

The three duplex plunger-pumps, shown at B B B (cellar plan), were furnished by Henry R. Worthington, New York, and are designated "compound steam-pumps, 18 $\frac{1}{2}$ inches and 29 inches diameter of steam cylinders, by 16 inches diameter of water-cylinders, by 18-inch stroke of plungers.

The overhead pressure water-tanks are 14 feet long by 6 feet diameter; have dished or bumped heads; they are

made of $\frac{3}{8}$ -inch iron, provided with manholes double-riveted in the longitudinal seams, and tested in all respects like ordinary boilers. They rest on cast-iron saddles placed near the end, and are sustained in position by 15-inch I-beams, which, in the case of elevators 3, 4, 5, 6, 7, 8, 9, and 10, span the space represented by the Pine Street entrance and the recess opposite. The pair of tanks supported by each set of beams are connected so as to maintain uniform water-level as nearly as possible.

CONNECTIONS.

The suction-pipe between the tanks P P, and steam-pumps B B, is placed in an open-walled subway. The pipe is of cast iron throughout, is 20 inches diameter, and $\frac{3}{4}$ -inch thickness of metal. Special 20-inch angle-valves, with soft disks, were designed and manufactured by Jenkins Brothers for this pipe, their weight being 2,860 pounds each. A tee is placed opposite each pump, with flanges looking upward, on which are bolted 14-inch angle-valves, with vertical flanges, connecting with the 14-inch Y-branches peculiar to the Worthington pattern. The office of these valves is to shut off any single pump from service.

The discharge-pipe C C is 15 inches diameter. This pipe, although 16 inches diameter, is made of only $\frac{1}{2}$ -inch material tested to a pressure of 150 pounds per square inch. It is necessarily overhead, and is chosen of this material for its extreme lightness of section. Branches 51, 52, 53, 54, and 55, of wrought-iron pipe, 10 inches diameter, discharge the circulating water into the several tanks at the head of the elevator-wells, one 10-inch pipe to each tank or pair of elevators. Each branch is provided with an independent gate-valve near the discharge-main, also a means of draining the branch into the open water-tanks P P.

The water from the overhead tanks to the elevator cylinders is returned, under pressure, through wrought-iron pipes 6 inches diameter, an independent pipe to each elevator. A gate-valve is placed on each pipe near the tanks for purposes of disconnecting any elevator from the service.

The idea of isolating any elevator or member was constantly kept in view, and is provided for not alone in the elevator service, but throughout the engineering department of the entire building.

The pressure-tanks being five in number, and placed near their work, instead of having one central tank, avoided the necessity of heavy supports at any one portion of the building, the necessity of stopping for a leak, also the leading of pipes across the roof, which would be in the way and liable to burst from the effects of frost.

The tanks being placed at a point about 150 feet above the hydraulic cylinders of the elevators gives a natural hydrostatic pressure of about 64 pounds per square inch on the pistons. In addition to this pressure, the pumps are run at a speed that insures a forced pressure in overhead pressure tanks of about 20 pounds per square inch. A Locke automatic regulator of the entering stream governs the speed of the pumps, so that the pressure of about 80 pounds is preserved at the hydraulic cylinders with but slight fluctuation. An air-chamber is maintained in the top part of each pressure-tank, its shape being a chord of a circle about ten inches in vertical height at the highest point.

(TO BE CONTINUED.)

A WASHINGTON PLUMBING REGULATION DECLARED ILLEGAL.

(From the Washington Star.)

The Commissioners compelled to issue a permit to Mr. Hannan—The recently promulgated regulations declared to be beyond the authority of the Commissioners—Judge James thinks there ought to be a law.

In the Court in General Term to-day an opinion was delivered by Chief Justice Bingham in the case of the United States, *ex rel.* Daniel Hannan against William Ludlow, Engineer-Commissioner of the District, which probably renders void the regulations recently adopted by the Commissioners requiring plumbers to be examined before registration, and imposing other requirements upon plumbers before permitting them to engage in business as a plumber. The case came before the Court on the petition of Mr. Hannan to compel the Engineer-Commissioner to issue a permit to him to make the necessary excavation to introduce water into premises 822 Twelfth Street northwest, his application for such permit having been refused on the ground of non-compliance by Mr. Hannan with a certain regulation made by the District Commissioners April 23, 1887. The petitioner alleged that the requirements of the regulations made last April were made without authority; that they are unreasonable;

that they are in restraint of trade, an invasion of the relator's right to pursue his craft; that they are inconsistent with the common law, and are an invasion of the right of property, and that they impose on the relators burdens from which other trades are free.

THE ACT OF CONGRESS.

Chief Justice Bingham, in announcing the opinion of the court said these regulations were based on the act of Congress approved January 25, 1881, authorizing the employment of an inspector of plumbing, and investing the health officer with authority, under the direction of the Commissioners, to execute and enforce regulations governing plumbing, house-drainage, and the ventilation of house sewers, and providing penalties to be imposed upon persons neglecting or refusing to comply with such regulations when promulgated. In November, 1882, the health officer made certain regulations providing for the registering of plumbers, and the issuing of permits to make excavations, etc. The petitioner, alleging that he has complied with the regulations of November, 1882, sets forth that on the 1st of September last he made application to introduce water in the house 822 Twelfth Street, and permission was refused, and is still refused, on the ground of non-compliance with certain other regulations made April 23, 1887, by the Commissioners, purporting to be issued under the same act. It was these regulations that the petitioner claims are

WITHOUT AUTHORITY OF LAW.

unreasonable, and an unwarranted interference with his rights. It was also claimed that the order of the Commissioners of May 4 last, requiring plumbers previous to registering, to deposit \$3 as a registration fee, was not warranted, and imposed a burden on the plumber not imposed on other trades. Chief Justice Bingham included in his opinion the rules and regulations promulgated April 23 last, which among other requirements prescribe that no person shall be allowed to engage in the plumbing business or to do any plumbing-work whatsoever relating to the water-supply or drainage of premises in the District except a master plumber who shall have duly registered or an employee of a duly registered master plumber; and that no plumber shall be allowed to register until he shall have passed a satisfactory examination by the board constituted for that purpose. It is also required as qualifications for registering that the candidate shall be twenty-one years of age, a citizen of the United States for at least one year previous to his application, and be certified as a man of intelligence, good habits and character, by at least three responsible citizens. No objection was made by the petitioner, the Chief Justice said, to the regulations of November, 1882.

THE POWERS OF THE COMMISSIONERS.

The first objection to the regulations of April last was that the Commissioners had no power to make such regulations, the health officer being by the act of January 25, 1881, exclusively empowered to make them. The court held, however, that as the health officer can only execute and enforce such regulations as the Commissioners direct, the Commissioners must first direct what the regulations shall be. The court, therefore, did not sustain this objection. The other point made by the petitioners was that, conceding that the power to make such regulations resided in the Commissioners, the regulations in question are in excess of their legal authority, and therefore void. The court was not, the Chief Justice said, unmindful of the gravity of the question before it. The regulation of plumbing in its relations to the health of the community undoubtedly called for the wise exercise of all the powers possessed by the municipal authorities. On the other hand, the rights of citizens could not be invaded. He quoted authorities to show that municipal corporations only possessed such powers of regulation as were necessary to enforce powers specifically granted by law, and that an order cannot be made to contravene common law.

THE EXAMINATIONS UNWARRANTED.

The Chief Justice then summarized the requirements prescribed by the new regulations as necessary before a plumber could be registered, and said that the scheme to test the qualifications of a plumber was not warranted by the Act of January 25, 1881, authorizing the appointment of an Inspector of Plumbing, etc. The Court's construction of this act was that the regulations authorized by it applied not to the plumbers themselves, but to the work done by the plumbers, or, in other words, it was intended to secure good plumbing. This, the Court thought, was the entire scope of the statute. Nor did the Court think the Commissioners had any such power as these regulations applied conferred upon them by other acts referred to in the argument of the case, the acts relating to the control of streets, etc., it was not intended by Congress to grant such power. The Court reached this conclusion reluctantly. It may be that the Commissioners should possess the power they have attempted to exercise, and, if so, an appeal should be made to Congress. The Court's attention had been called, the Chief Justice said, during the examination of the case, to the act regulating steam-engineering in the District. The provisions of this act and the plumbing regulations issued by the Commissioners are so similar in structure that the suggestion at once comes to mind that these rules and regulations were patterned after this act. To the Court it seemed that the fact that Congress found it necessary to pass such an act in relation to steam-engineers suggested that the power should come also from Congress to enable the Commissioners to pass such regulations respecting plumbers.

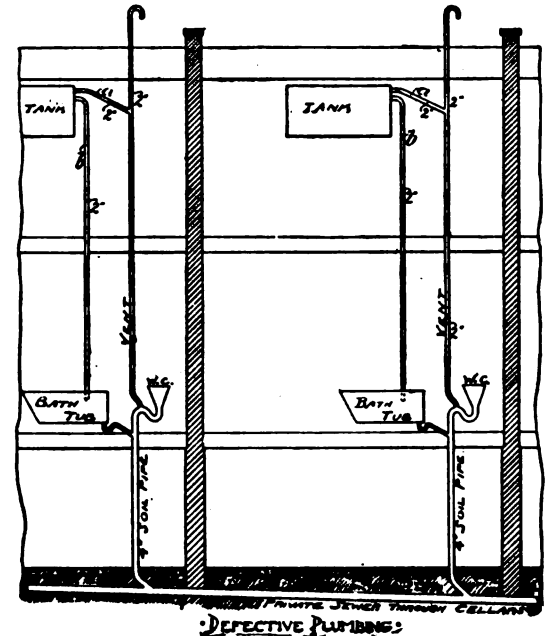
JUDGE JAMES IN FAVOR OF A NEW LAW.

* Judge James said he would like to add what might be an extra-judicial opinion. They were, he said, in the hands of the plumbers just as they were in the hands of the druggists. Both can poison them. It would be an extremely desirable thing if some one would have such a law passed as the Commissioners had framed respecting plumbers. Such regulations he deemed necessary. Whatever the Commissioners did, he said, was apt to be criticised as an act of tyranny. In this case he was sorry they have not the power to make the regulations. The Court recommended the mandamus to issue.

VIOLATIONS OF THE PLUMBING AND TENEMENT-HOUSE LAW IN NEW YORK CITY.

THE accompanying cut illustrates another of those unaccountable plumbing blunders, so often discovered by the Board of Health when called into premises where alterations have been made by careless or ignorant persons.

In this case a number of houses on Ninety-fourth Street, near Lexington Avenue, have two overflow-pipes to each house-tank. The overflow *a* was probably first put in and connected with the vent-pipe of the water-closet trap, itself being untrapped. This let the stench into the house-tank. Then, presumably, a plumber was called who put in the



second overflow *b*, to the bath-tub, which is right enough in itself, but he either forgot to cut off the first pipe *a*, or he plugged it, thinking that sufficient, when some one following him removed the plugs, letting the sewer-air into the house again. What makes this matter worse than ordinary is the fact that the house-drains enter a private sewer through the cellars, making a communication between adjoining houses through the lines.

This was ordered to be made safe.

In the case of the new building on the north-west corner of Thirtieth Street and Eighth Avenue, the plans filed did not leave the space at the rear as required by law and were therefore disapproved, notwithstanding which the owner, F. Donnelly, proceeded to put his building up. The inspector found and reported the violation and notice thereof was served. The owner seemed to think it was only a matter of form and did not pay any attention to the notice, until it was referred to the attorney of the board, and he was arrested. He is now taking down the rear and altering the building so as to have it four feet shorter than before and otherwise remodeling the inside to conform thereto. Evidently it would have saved him time and expense to have heeded the warning of the chief inspector.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Kickerbocker Gas-Light Company.	Equitable Gas-Light Company.
October 22.....	25 34	21.07	21 85	28.03	30.47	24.51	30.67

E. G. LOVE, Ph.D., Gas Examiner.

THE Philadelphia Company of Pittsburg makes the following statement showing the number of boilers and furnaces using natural-gas in October, 1866, and October, 1887:

	1866.	1887.
Boilers.....	803	1,164
Puddling furnaces.....	551	492
Large heating furnaces.....	439	517
Dwelling houses.....	4,000	9,000
Cubic feet of gas used in one day in the city.....	250,000,000	375,000,000
Present capacity of wells.....		1,200,000,000

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A HOUSE FILTER WANTED.

NORTH CAROLINA BOARD OF HEALTH,
RALEIGH, N. C., October 22, 1887.

SIR: Will you kindly inform me of some inexpensive forms of house filters at present in the market which are efficient and easily kept in order?

Yours truly, ARTHUR WINSLOW.

[Referred to our readers.]

NOISE IN THE KITCHEN BOILER.

SIR: As a subscriber of your paper I take the liberty to ask you a few questions in regard to a boiler which makes an awful noise. The pressure it receives is from 70 to 80 pounds. The boiler is a copper one. I am positive it is not the pressure or the make of the boiler, and I therefore give you a sketch. Thanking you for an early reply, I remain one of your anxious readers, E. S.

[We are of the opinion your water-back is too large for the amount of water drawn from the boiler. Place a fire-brick in front of the water-back and try what it will do for you. If a whole brick proves too much use a part of one. If that remedies the evil use a smaller water-back hereafter.]

DEPTH OF ARTESIAN WELLS.

SIR: A few days since a discussion took place at a prominent New York City club between the owner, architect, and contractors of an extensive bathing establishment now in the course of construction in this city, upon the subject of artesian wells, one being now sunk for the bathing establishment referred to, of which Mr. Thomas A. Poole is the architect.

It was claimed that the deepest artesian well in this country had been sunk by Messrs. Belding Bros. & Co., silk manufacturers, of Northampton, Mass. Will you please oblige us by stating whether this is so and also by giving any further information on the subject that you conveniently can? Respectfully, B.

[In answer to the above query we give the following extract from a letter received from Messrs. Belding Bros. & Co., dated October 15, 1887:

"The deepest artesian well we have sunk is at Northampton, Mass., 3,700 feet. The next deepest well in America is at St. Louis, Mo., 3,180 feet, which furnishes a large supply of sulphur water.

"The deepest well in the world is in Prussia, a Government work, and something over 4,000 feet deep and furnishing hot water.

"The bore in our well is 8-inch and we worked 2½ years on it. We struck the rock at 150 feet (a sedimentary sandstone) and never got through it and got no water, although at Holyoke, Mass., 9 miles south of us, they get unlimited supplies of good water at 600 feet."

It may be of interest to add that a well was sunk 3,235 feet to supply the county buildings of St. Louis County, Miss., but without success. The largest well in the world is believed to be that at Passy, near Paris. It is two feet in diameter, 1,913 feet deep and delivers 3,795,000 gallons per day. The most celebrated is at Grenelle, a suburb of Paris, with a depth of 1,802 feet and a delivery of 880,000 gallons per day, with a force sufficient to raise it 120 feet above the surface. Wells 1,500 and 1,800 feet deep are said to exist in the province of On Tong Kiao in China.]

NEW JERSEY SANITARY ASSOCIATION.

THE thirteenth annual meeting of the association will be held at Trenton Friday and Saturday, October 28 and 29.

The following is the order of business:

FRIDAY, OCTOBER 28.

Meeting called to order at 10:30 A. M. Report and announcements by the Secretary. Paper on "The Prevention of the Spread of Contagious Diseases through the Schools," by J. Y. Simpson, M. D., of Orange. Discussion opened by T. W. Harvey, M. D., of Orange. Paper on "The Legal Aspects of the Question of the Pollution of Streams," by E. S. Atwater, Counselor-at-Law, of Elizabeth. Discussion opened by W. H. Lanning, Esq., of Trenton. Report of the Treasurer and Miscellaneous Business.

Afternoon Session, from 2 to 5 o'clock.

"Methods of Sewage Disposal in New Jersey," as described by those who have put the systems in operation—viz.: J. J. R. Croes, C. E., of New York City; C. Phillips Bassett, C. E., of Newark; George P. Olcott, C. E.,

of Orange, and others. Discussion opened by James Owen, C. E., of Newark; J. W. Pinkham, M. D., of Montclair. Paper on "Neglected Drainage Areas in New Jersey, and what should be done to improve them," by Professor George H. Cook, Ph. D., of New Brunswick. Discussion opened by L. B. Ward, C. E., of Jersey City; Professor A. R. Leeds, Ph. D., of Hoboken.

Evening Session, at 7:30 o'clock.

Prayer. Annual Address by the President, William K. Newton, M. D., of Paterson. Subject, "Sanitation Militant." Addresses on the sanitary bearings of the following educational topics: 1. The Length of School Days and Terms; 2. Recesses; 3. Competition; 4. Industrial Education; by Hon. E. O. Chapman, State Superintendent of Schools; Prof. Nicholas Murray Butler, President Industrial Educational Association; Prof. James M. Green, of Long Branch; Prof. C. E. Meleney, of Paterson; Prof. Charles Jacobus, of New Brunswick; Prof. Wright Eckersley, of Long Branch.

SATURDAY, OCTOBER 29.

Morning Session, from 9 to 12:45 o'clock.

Paper on "Poisons in Foods of Animal Origin," by Shippen Wallace, Ph. D., of Burlington. Discussion opened by Prof. F. A. Wilber, of New Brunswick; Dr. William K. Newton, of Paterson. Paper on "The Tenement-House Problem in Cities," by James C. Bayles, M. E., President of the New York City Board of Health. Discussion opened by D. Benjamin, M. D., of Camden. Paper on "House Sanitation," by Henry Mitchell, M. D., of Asbury Park. Discussion opened by Rev. A. E. Ballard, of Ocean Grove.

Afternoon Session, from 2 to 4:30 o'clock.

Election of officers. Paper on "The Collection and Disposal of Garbage," by E. L. B. Godfrey, M. D., of Camden. Discussion opened by Prof. H. B. Cornwall, of Princeton. Paper on "Vital Statistics," by E. M. Hunt, M. D., Secretary State Board of Health. Discussion opened by D. L. Wallace, M. D., of Newark; J. C. Pumpelly, Esq., of Morristown. Miscellaneous Business and adjournment.

The officers are: President, W. K. Newton, M. D., Paterson; First Vice-President, E. L. B. Godfrey, M. D., Camden; Second Vice-President, Henry Mitchell, M. D., Asbury Park; Recording Secretary, D. C. English, M. D., New Brunswick; Corresponding Secretary, Prof. J. Madison Watson, Elizabeth; Treasurer, J. C. Pumpelly, Morristown.

The Local Committee of Arrangements consists of W. W. L. Phillips, M. D., C. T. Ridgway, Esq., E. M. Hunt, M. D.

AN ADVANCE IN WROUGHT-IRON PIPE.

AT a well attended meeting of the Wrought-Iron Pipe Manufacturers of the United States, held on October 26 at the Fifth Avenue Hotel, New York City, it was unanimously decided to raise the prevailing card rate 2½ per cent. on all sizes of pipe.

Within the past five years this branch of the iron industry of the United States has more than doubled. The discovery of new natural gas and petroleum fields and the determination of telegraph, telephone, and electric-light companies to do away with overhead wires are creating a great demand for wrought-iron pipe, and the development of the great petroleum fields in Russia is adding to the demand for pipe all the time.

Novelties.

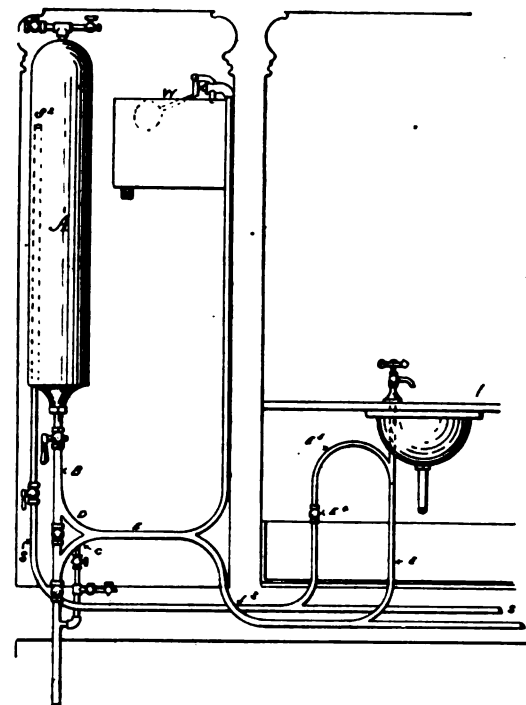
Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

WATER REGULATOR AND ACCUMULATOR FOR HOUSE PURPOSES.

THE accompanying cuts show a novel contrivance for the purpose of utilizing the power which produces a water-ram or concussion in the pipes, to raise water to a higher level than the natural pressure of the works would send. In other words, a Brooklyn inventor has taken out a patent for a device in which he proposes to utilize the water-hammer in the plumbing pipes of a house to drive water into a storage tank. The greater the nuisance to the householder from the water-hammer due to defective plumbing the more water will be accumulated in the tank. If you want to get water into the tank it is only necessary to keep opening and shutting the faucet down stairs, and by-and-by you will get your tank full if you have patience and determination.

The figure represents the whole system on the second floor of a dwelling showing the mode of connecting the water-

pipes with the water-closet cistern W, directly over the main supply line B, and wash-basin, in an adjoining room. The closing of a faucet suddenly forces water through



CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ENGINEERS' CLUB OF PHILADELPHIA.

A REGULAR meeting of the Engineers' Club was held October 1, 1887.

Past-President Washington Jones in the air; 30 members and 4 visitors present. Mr. J. M. Cameron, introduced by Mr. Henry G. Morris, described the Carnell air-ector.

This machine is intended to supply air to the furnaces of steam-boilers of all classes. Steam is taken from top of boiler and carried through the combustion-chamber, where it is heated to about 900° Fah., then to a distributing-apparatus discharging under the grate. The steam, heated to the condition of a gas, takes with it the necessary air for combustion. It is claimed that the heat to which the steam is raised, in connection with a reduction of pressure to 20 pounds per square inch, increases the relative volume to 1,800, which would be eight times more effective than saturated steam. The heat taken from combustion-chamber is given out to the air entering the furnace. Tests are said to have shown an increased boiler-power of 28 to 100 per cent., with a proportionate saving in fuel of two per cent. above that obtained by natural draught.

Mr. Henry G. Morris exhibited and described a working model of a traveler to carry wires, ropes, etc., through conduits, which he had devised.

The apparatus consists of two parts, one placed ahead of the other, and each provided with spring claws which will slide ahead in the conduit, but will take hold of the sides and prevent any backward motion. The parts are operated by two cords working on a system of pulleys, so that, by the alternate pulling of the cords, the whole apparatus will move ahead of the operator through the conduit. That is to say, pulling one cord will drag the rear piece up to the front piece, and pulling the other cord will send the front piece a distance ahead, each part, with the attached pulleys, holding firmly to the sides while the other part is being moved.

Prof. L. M. Haupt made some remarks upon his "Experiments with Current Deflectors at Five-Mile Bar," and showed how urgently the city and river interests required a channel across it. He then suggested a plan whereby he proposed to create a channel, sufficient to meet the demands of commerce.

The Secretary, Mr. Howard Murphy, announced the death, since the summer adjournment, of Mr. Frank Maddock, active member of the club.

ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting of the Engineers' Club of Kansas City was held at the Deardorff Building, October 3, 1887, J. A. L. Waddell, Vice-President, presiding; T. F. Wynne, Secretary, pro tem.

Upon a canvass of ballots, E. W. Stern, Charles H. Talmage, and Charles W. Hastings were elected members.

The paper of the evening on "The Construction and Operation of the Ninth Street Cable Railway," prepared by Mr. M. K. Bowen, was read by Mr. C. G. Wade.

Mr. P. W. Keersted was proposed for membership by G. W. Pearson and J. A. L. Waddell.

Mr. Keersted was invited and consented to read a paper at the next meeting, subject to be announced.

PLUMBING JOBBERS' CLAM-BAKE.

THE New England Association of Jobbers of Plumbers' Supplies are to have a "genuine Rhode Island clam-bake" at the Club House, Providence River, on Friday, November 11, next. Guests will assemble at Narragansett Hotel, Providence, at 10 A. M. on that day.

ARCHITECTURAL COMPETITIONS.

FORT WAYNE, IND.—The Committee (Messrs. Dockman, Woulfe, Read and Michell) will advertise at once for plans for the new city hall.

LOS ANGELES, CAL.—The President of the St. Vincent Hotel Company, Major E. W. Jones, will advertise at once for proposals for plans, etc., for building a \$400,000 hotel.



For works for which proposals are requested see also the "Proposal Column," pages 601-604-608.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE. ETC.

LOS ANGELES, CAL.—The Mayor will appoint at once three local engineers to pass upon the sewerage plans.

BRIDGEPORT, CONN.—The Board of Public Works will advertise at once for the construction of sewers.

SAVANNAH, GEO.—A movement is started to obtain a complete system of sewerage (small pipes and flush-tanks).

MILWAUKEE.—Water-mains will be laid in 24th Street, from Galena to Walnut Street, one block, and from 23d Street to 24th Street, and Walnut Street. Valentine Blatz is erecting well-boring machinery on Johnson Street for the purpose of deepening the artesian well at Blatz's Brewery.

WEST STRATFORD, CONN.—There is talk of erecting water-works on Success Hill to supply the borough of West Stratford and the town of Stratford.

ELYRIA, O., must have larger water-supply.

COSHOCTON, O., voted October 24 to build water-works.

JACKSONVILLE, ILL.—Address the City Clerk at once in regard to plans for better water-supply. City Council has the matter under discussion.

POTWIN, KAN., is to have a sewerage system costing \$12,000. For further particulars address John T. Clark.

FRANKLIN, MASS.—The stand-pipe of the water-works burst on October 26; loss, \$8,000 to \$12,000.

CHARLESTON, S. C.—The Water Committee has reported that a new reservoir should be built at a cost of \$12,000, and a new 1,000,000-gallon pumping-engine be bought to increase the water-supply. Council has adopted the report. Address the City Clerk or W. B. Lawrence, of Water Committee of City Council.

WEST ORANGE, N. J.—Our correspondent writes: "There have been no steps taken to establish water-works in the township of West Orange—nothing more than a communication from D. N. Roper, offering an opportunity to the town authorities to avail themselves of one."

REDDING, CAL.—Parties are surveying a ditch from Spring Creek, six miles north of Redding. The work is reported to be for another water company for the city.

MARBLEHEAD, MASS.—At a town meeting held October 18, at Marblehead, it was voted to issue bonds to the amount of \$42,000 for water-works. It was also voted that the water commissioners be authorized to have a survey of the whole town made, and that the commissioners report at an early day an estimate of the cost of construction.

WATER COMPANIES.—Incorporated in Pennsylvania are the Loyalhanna Water Company of Westmoreland County, and the Salem Water Company.

DULUTH, MINN.—Surveyors commenced work on the dikes of the St. Louis River to locate the sites of 10 dams for the St. Louis River Water Power Company, of which Jay Cooke and New York, Philadelphia, Chicago, Milwaukee, Minneapolis and St. Paul capitalists are large stockholders.

CEDAR RAPIDS, IOWA, Water Company will bore an artesian well near the works. The contract has been let to the Miller Artesian Well Company, of Chicago. The contract calls for a well 2,500 feet deep, if it is found necessary to go that far to secure a supply of water.

MAYSVILLE, KY.—Our correspondent writes: "This company does not intend to make additions to pipe lines and machinery before spring."

GEORGETOWN, KY.—The construction of water-works is actively discussed here. Address the City Clerk.

ALTOONA, PA.—Address C. W. Knight, Consulting Engineer, on pumping machinery, etc., needed for extending the water-supply, which Mr. Knight is now planning. President Kilgore, of Common Council, may also be addressed.

ST. LOUIS, MO.—It is proposed to erect a pumping-station at the Chain of Rocks. Address Mayor Francis.

JERSEY CITY, N. J.—The Green Gauge-Tube Well Company want to get a chance to supply the city with water, in case the present plant is abandoned. Clerk Finck, of the Board of Works, has been directed to notify them to present a proposition.

BUNKER HILL, ILL.—Our correspondent writes: "The proposition to establish water-works is only discussed and nothing tangible arrived at. It is a question to be looked into by the Citizens' League. There is no immediate prospects that they will be established."

HELENA, MONT.—Our correspondent writes: "The Helena Water Company, a corporation having a franchise from the City of Helena, has sunk a well and is building pumping-works and a reservoir, and laying 15 miles of pipes for a system of water-supply. George F. Woolston, manager. The city is about to enter upon the construction of a system of sewerage to cost \$150,000. Plans are not yet matured."

VALLEY FALLS, KAN.—The following bid for constructing water-works was received by H. D. Butts, City Clerk, October 15: U. S. Wind Engine and Pump Co., Batavia, Ill., \$14,778, and the contract was let to them.

TORONTO, ONT.—The scheme for new water-pipe, new pumping-engines, etc., to which we have previously referred, has been endorsed by City Council. Address Alderman Boustead.

SYRACUSE, N. Y.—The Syracuse and Salmon River Water Company has applied to the City Council for a franchise. Mr. W. A. Sweet is president.

NEWPORT, R. I.—Next month the taxpayers will vote upon the expenditure of \$100,000 for the completion of the sewer system. The city invited three gentlemen to inspect the trunk sewer and outlet and make a report—viz.: George E. Warren, Professor Fairman Rogers, of Philadelphia, and Mr. Charles E. Hammett.

AUSTIN, TEXAS.—Our correspondent writes in reference to the Sylvester Watts Water Company: "Right of way was refused the Sylvester Watts Company by our City Council, and they are not doing any construction of water-works in this city. We have one water company which has been in operation some ten years."

GRAND RAPIDS, MICH.—The Board of Public Works on October 19 had up for discussion plans and estimates for supplying the city with water prepared by J. D. Cook, C. E., of Toledo. Work will be done.

MONTROSE, CAL.—Our correspondent writes: "Franchise granted to C. E. McConnell, et al., to construct water-works, but don't think there will be anything done in the matter for two years anyhow."

WEST DE PERE, WIS.—Our correspondent writes in regard to water-works: "The matter is a private enterprise, as at present talked of, and not a city matter. There will probably be an artesian well put in by private parties, and the city will probably take some steps to get a supply of water from it when furnished. J. P. Willard, of this city, is interested."

SOUTH EVANSTON, ILL.—The matter of a contract with G. C. Morgan for supplying water seems not to be settled yet. The source is to be driven wells.

POMONA, CAL.—Address P. C. Towner about his project for piping water from the Cy Burdick property to the city.

HERKIMER, N. Y., is experimenting with the sinking of wells for a water-supply.

CLAYTON, N. Y.—Our correspondent writes: "There have been no steps taken as yet to establish water-works here. Last season there was some kind of talk about putting in the Holly system, but the town bought a Silsby fire-engine as a protection in a case of fire, and I think it doubtful if the town would take any action on water-works for the present."

SPRINGFIELD, ILL.—Our correspondent writes: "Our Commissioners have as yet not decided whether to put in water galleries or tube wells. The water is very low. The project should be pushed with dispatch at once."

LAKE, ILL.—After much discussion the contract for furnishing a pumping-engine has been awarded to the Holly Manufacturing Company, of Lockport, N. Y.

SANTA ROSA, CAL.—Our correspondent writes in reference to water-works on Mark West Creek: "At an adjourned meeting of the Common Council of the city of Santa Rosa, the petition of J. B. Davis and his associates for a franchise to lay water-pipes and to carry water into the city from Mark West Creek was granted and a committee, of which the Hon. A. P. Overton, Mayor, is chairman, appointed to draw up a proper ordinance. There is no doubt but what the new water works will be a success and completed within a short period."

BARRE, ONT., has voted against the introduction of water-works.

MILWAUKEE.—An additional sum of \$60,000 has been appropriated by the Council for the purpose of constructing the 12-foot flushing tunnel from Lake Michigan to the Milwaukee River. It will be 2,500 feet long and will have a mean fall of 12 inches. It will be 75 to 85 feet below the surface of Dane Place. The engines and boilers will be located on the lake shore and have a capacity of 350 millions of gallons daily. It was decided to recommend to the council a resolution instructing the Board of Public Works to advertise for bids upon and to award contracts for the construction of the tunnel.

JAMESTOWN, N. Y.—The Jamestown Water-Supply Company has bought the Southland Farm, and will begin at once the erection of a pumping plant and laying water-mains.

GREENBUSH, N. Y.—On October 24 the Sewer Commissioners awarded the contract for the first section of the sewer system to McGowan & Van Vranken, of Schenectady.

ST. JOHNLAND, L. I.—We recently noted that plans were to be prepared for the Charities Commissioners for water and sewerage works, roadmaking, and other improvements at the St. Johnland County Farm. Chief Engineer Carey has now presented the plans and specifications. They call for a reservoir, pumping engine, much cast-iron and stoneware pipe, valves, hydrants, etc., considerable excavation and masonry work and sewer construction, both brick and pipe. The cost is estimated at \$350,000. The Board of Supervisors of Queens County have the estimate under consideration.

WIARTON, ONT.—Water-works will be built here. Address, until November 1, T. D. Galloway, Clerk of the Municipality.

WATER-WORKS.—Proposals will be received for a system of water-works for Winchendon, Mass. The Fire Commissioners and a committee of citizens have been authorized to obtain plans for the construction of works for fire and domestic purposes. The water will be supplied from artesian or driven wells, or from Naukeag Lake in Ashburnham. Council has appropriated \$500 for Survey. Address the Water-Works Committee.

ELLENVILLE, N. Y.—The Board of Trustees on October 19 voted to authorize the issue of \$16,000 of bonds for increasing the water-supply.

GAS AND ELECTRIC-LIGHTING.

EAST SAGINAW, MICH.—The Hartford Electric-Light Company is organized.

INCORPORATED in Ohio is the Holmes County Gas and Oil Co.; capital stock, \$9,000.

ST. CLOUD, MINN.—J. H. Woolsey, of the United States Electric-Light Company, of St. Paul, will erect a light plant here.

PLAINFIELD, MASS.—Plainfield is to have incandescent electric-lights.

BALTIMORE, MD.—Mayor Hodges has vetoed the ordinance making a five-years' contract with the American Electric-Light Company.

KNOXVILLE, TENN.—City Council has directed the Mayor to annul the contract with the Knoxville Gas Company and obtain electric street-lamps.

SANDUSKY, O.—Under a contract made with the gas company October 10, all the gas-posts in the city will be displaced by electric-lamps.

LAREDO, TEX.—City Council has propositions before it looking to lighting the streets with electricity.

INDIANAPOLIS, IND.—The Indianapolis Natural-Gas Company has contracted with Pittsburg parties to furnish twenty miles of pipe and fittings for the gas lines. A. M. Fletcher is a director.

EAST ST. LOUIS, ILL.—Incorporated is the Pike Electric Company, of East St. Louis; capital stock, \$25,000. Messrs. Edward W. Pike, N. Oscar Gray, and Sherman B. Pike, incorporators.

HYDE PARK, MASS.—The town has contracted with the American Electric Manufacturing Company to furnish double arc-lights of 2,000-candle-power each, at an annual cost of \$70 per light, for a term of three years. Any additional lights must be furnished at the same price, and under same conditions.

EDWARDVILLE, ILL.—has made a five-years' contract for electric street-lighting.

GLENS FALLS, N. Y.—is discussing lighting the streets by electricity.

JERSEY CITY, N. J.—The Police Board, October 19, decided to renew last year's contracts with the companies holding them for gas, electric and oil lights. The contract with the Jersey City Electric-Light Company is to be for forty or more lights at the rate of 40 cents per night.

WASHINGTON, D. C.—The Westinghouse Electric Company has received notice that it has been awarded the contract for lighting the Senate Chamber of the Capitol at Washington. This contract calls for 1,300 electric-lights, which will include all candle-power from 9 to 16, 25, 50, 75, 100, 150. The entire plant will be placed in the building, including the power, machinery, and other essentials.

WASHINGTON, KAN.—Incorporated is the Washington Electric-Light and Power Co.; A. W. Moona, and others.

BATTLE CREEK, MICH.—Incorporated is the Battle Creek Electric-Light and Power Co.; W. A. Foot, and others.

RICHFIELD SPRINGS, N. Y.—will have electric street-lights. Address Dr. N. Getman.

LOWVILLE, N. Y.—The Village Board has granted John D. Moore privilege to erect poles and wires for electric-lighting. The lamps are of the American Electric-Light Manufacturing Company.

ALLENTOWN, PA.—has signed a contract with the Allentown Electric-Light and Power Company to light the streets with electric-lamps.

LIMA, O.—Address the Lima National Gas-Company about street-mains, etc., for their plant.

HURON, DAK.—is to have electric-lights.

CHATHAM, ONT.—wants to obtain an electric-light plant for her streets.

SAULT STE. MARIE, MICH.—has granted a thirty years' franchise to a natural-gas company to sink wells and lay mains.

ORANGE, N. J.—has at last granted a franchise to the Edison Illuminating Company to erect poles and wires for lighting.

NEWTON, KAN.—Wells will be sunk for natural gas.

WEST MIDDLETOWN, PA.—Incorporated is the Citizens' Light and Heat Company, of West Middletown.

BELVIDERE, N. J.—The Belvidere Gas and Electric-Light Company has purchased the entire plant, machinery and poles necessary for lighting the town by electricity.

STEAM-HEATING, BUILDINGS, ETC.

MONTREAL, CAN.—Dows & Son, of Ottawa, have the contract for the depot of the Canadian Pacific Railway.

SEWARD COUNTY, NEB.—will vote November 8 on raising \$75,000 for a court-house.

CINCINNATI, O.—Proposals will be received until November 19, at the office of W. B. Smith, for the erection of an armory; Hannaford & Sons, architects.

POTTSTOWN, PA.—Neff Bros. are establishing a silk mill plant under the title, Pottstown Silk Mill Association. The building will be brick, 3 stories high, with engines, electric-light dynamo, and shafting. There will be steam-heating apparatus also. Time for bidding is extended to October 29. Address G. F. Malsburger, Pottstown, Pa.

PHILADELPHIA.—The Pencoyd Iron and Steel Works are building a 200x200 foot brick and iron bridge shop and will put in new battery of boilers, compressors, accumulators, and hydraulic and forging plant.

POTTSTOWN, PA.—The contract for steam-heating the Security and Trust Company's new building is to be let. Address Edwin Bartollett, architect, Phoenixville, Pa.

WHITESTONE, L. I.—A machine works will be built here. W. D. Bishop, of Bridgeport, Conn., is Manager; capital, \$2,000,000.

WILKESBARRE, PA.—Organized is the Nanticoke Steam Heat, Power and Water Company. Work upon the plant will be begun at once, and upon the trenches for the pipes in a very few days. President, Sol. Hirsch; Vice-President, Henry Connell; Treasurer, J. C. Brader; Secretary, Lawyer Fritz.

KALAMAZOO, MICH.—The Supervisors will hold an election on the question of raising funds for a new county almshouse.

ROME, N. Y.—See our Proposals for reference to heating apparatus, etc., for the Central New York Institution for Deaf Mutes.

PORTLAND, ME.—Coffrod & Saylor, of Philadelphia, have contracted with the Union Station Company to build the iron train sheds here. The contracting price is said to be between \$75,000 and \$80,000. Mr. M. W. Wisler has charge of the work.

BRIDGES.

ST. LOUIS, MO.—On November 15 the Board of Public Improvements will award contracts for iron superstructure of the Grand Avenue Bridge.

BRIDGES.—See our Proposals for reference to bridges at St. Louis, Mo.

BEVERLY, MASS.—Thomas D. Lovett is at work upon plans for a proposed bridge over the railroad to Bridge Street, Rial Side.

BRIDGE.—A contract has been let to the San Francisco Bridge Company for \$32,801 to build a bridge across the Mojave River between Daggett and Calico, Cal.

TRENTON, N. J.—The contract for building the bridge over Miry Run, near Newtown, was awarded October 22 by the Board of Freeholders. Austin Walton secured the mason work for \$1,400, and the New Jersey Steel and Iron Company will do the iron work for \$850.

LEAVENWORTH, KAN.—Our correspondent writes: "I understand arrangements are being made for the construction of a bridge across the Missouri River opposite this city. A company has been organized and a charter obtained for such purpose."

EAU CLAIRE, WIS.—The municipal election October 18 on the proposed issue of \$25,000 bridge bonds resulted in favor of the issue of bonds.

DUBLIN, GEO.—Our correspondent writes: "No steps have been taken whatever by the town or county for a bridge. There has been some talk of submitting the question of building a bridge by issuing bonds by the the county and town to a vote of the people of the county and town."

NEWARK, N. J.—Our correspondent writes in regard to the proposed bridge over the Passaic to Kearney: "The only action taken so far, October 24, has been the appointment of a joint committee of Essex and Hudson Counties to consider the subject."

KANSAS CITY, MO.—The contract for a bridge at Montgall Avenue, this city, has been awarded to the Kansas City Bridge and Iron Company.

SACRAMENTO, CAL.—The Board of Supervisors October 19 opened bids for the construction of a new bridge across the American River at Twelfth Street. The bids were as follows: McKinnon & Tumelty, Stockton, \$36,700 and \$37,500; B. McMahon & Co., San Francisco, \$33,750; San Francisco Bridge Company, \$29,977; King Iron Bridge Company, of Cleveland, O., \$29,994, \$32,795, and \$44,895; American Bridge and Building Company, \$29,675, \$32,650, and \$48,600; Pacific Bridge Company, \$37,281; California Bridge Company, \$43,786, \$34,697, \$29,970, \$24,875. The bids were referred to the Committee on Contracts.

MARINETTE, WIS.—will build a \$60,000 bridge over the Menominee.

ZANESVILLE, O.—The County Commissioners will build a bridge over Muskingum River.

LEWISVILLE, O.—The County Commissioners will build a bridge here.

TOWSONTON, MD.—A bridge will be built here.

WACO, TEX.—Proposals will be received for an iron bridge over the Brazos River. Address, until November 14, the Commissioners' Court, Waco, Tex.

WATERTOWN, N. Y.—The King Iron Bridge Company, of Cleveland, O., and the Wrought-Iron Bridge Company, of Canton, O., have been awarded the city contracts for constructing bridges across the north and south branches of Black River, at \$10,000 and \$3,350 respectively.

WESTFIELD, MASS.—The County Commissioners have adopted plans for crossings of the N. H. & H. R. R. at this place.

DEFIANCE, O.—See our Proposals in regard to bridges in Defiance Co., O.

BELLOWS FALLS, VT.—The Cheshire Railway will build a bridge here. R. Stewart, General Manager, at Keene, N. H., may be addressed.

HOLLISTER, CAL.—The Commissioners will build a \$15,000 bridge over the San Benito River.

ASHTABULA, O.—The County Commissioners will build a \$30,000 bridge.

SIoux CITY, IA.—The contract for building the trestle work and stone abutments of the east approach of the Missouri River has been let to Wakefield & Hill, of this city.

WASHINGTON, MO.—A bridge will be built over the Meramee River at Short's Ford. The contract for abutments has been awarded to Ira Rean at \$5,000.

APPONAUG, R. I.—The award of contract for an iron bridge at Crompton has been postponed until November 7. Address the Town Clerk of Apponaug.

MILWAUKEE.—The Milwaukee Bridge and Iron Co. has been awarded the contract for the Belle Isle bridge at Detroit for \$295,000.

CHATTANOOGA, TENN.—Still another company desires a charter to build a bridge across the Tennessee River.

COLUMBUS, NEB.—An election was held in this city October 17 to vote \$30,000 in bonds to build a permanent bridge across the Loup Fork. The bonds were carried, 348 voting for them and 6 against.

SAN DOMINGO.—Constable Bros., engineers of New York, have furnished plans for a wrought-iron drawbridge for San Domingo.

BIRMINGHAM, ALA.—The Birmingham Bridge and Bolt Works Company has been incorporated at Birmingham, Ala., with a capital stock of \$100,000.

BROOKLYN BRIDGE.—Bids for iron and steelwork of approach: The New Jersey Steel and Iron Works, 5.57 cents per pound erected; Keystone Bridge Company, 7.34 cents per pound erected. The contract was awarded to the New Jersey Steel and Iron Works. The Dickinson Manufacturing Company, of Scranton, Pa., has the contract for two switching-engines, to weigh 44,000 pounds, and to cost \$5,500 each.

STREET WORK AND PAVING.

LITTLE ROCK, ARK.—The paving of Main Street will be pushed. Address Fred Rickon, City Engineer.

SAVANNAH, GEO.—Address the Council Committee on Streets in regard to much paving and other work now to be done.

DAVIS AVENUE, WEST CLEVELAND.—will be paved, etc. Address the Clerk, A. P. Fairbank, 18 Wade Building, Cleveland, O.

ST. LOUIS, MO.—The Board of Public Improvements will award contracts November 7 for wood and granite paving.

TORONTO, ONT.—Plans are being prepared for the Esplanade improvement.

ST. LOUIS, MO.—On November 21 contracts will be let by the Board of Public Improvement for much grading and paving. Address Henry Flad.

JERSEY CITY, N. J.—Ogden Avenue will be improved, sewered, etc.

PITTSBURG, PA.—Address E. M. Bigelow, City Engineer, about improvements of Carson Street, and sewers in various streets and alleys.

ARENAC, MICH.—A new State road is to be constructed in Arenac County, between the towns of Arenac, Au Gres, Mason, and Turner. It will be over ten miles long.

COLUMBUS, O.—A great deal of street-work is projected here, as the following estimate of the City Engineer, recently made, shows: Grading and constructing a stone block pavement and setting 5-inch curb on Long Street, \$234,722.50; Medina stone for above, \$226,675; street-railway's portion, \$61,500; grading and constructing a Hayden block or fire-clay brick pavement on Mount Street, \$11,070; West Virginia fire-clay brick for above, \$10,025. Medina or granite curb in place of Berea curb would cost about \$1,450 more.

SAN DIEGO, CAL.—The only bid presented October 13 to the City Trustees for paving certain streets was withdrawn, and the work will be readvertised. The estimated cost is more than \$500,000.

LEAVENWORTH, KAN.—Address City Engineer G. T. Nelles in regard to paving Third Street.

WORCESTER, MASS.—Address the City Engineer in regard to extensive paving and other improvements to be made to the streets.

RAILROADS, CANALS, ETC.

HOWESVILLE, KY.—The Howesville and Pellville Mineral Railroad Company was organized October 24 with General D. L. Adair as the presiding officer. It is proposed to build a road from this place to Pellville.

NEVADA CITY, CAL.—The Board of Supervisors has granted a franchise for an electric railway from Nevada City to Grass Valley to the Directors of the Nevada County Land and Improvement Association.

NAPA, CAL.—A contract has been let to J. T. Davis to grade twenty miles of the Napa, Lake and Humboldt Railroad between Conn and Bull's canyons. The work will be pushed.

KNOXVILLE, TENN.—Chief Engineer Ramsner, of the Carolina, Knoxville and Western Railroad, is prosecuting surveys from Nashville to Emory Gap.

SAN DIEGO, CAL.—Address H. L. Storey, of the San Diego Street Car Company, in regard to several projected lines, electric and horse.

ELIZABETH, N. J.—City Council has granted a franchise to the Elizabeth Street Railway Company to build an electric motor line.

DENVER, COL.—The Denver and West Side Cable Railway Company has filed articles of incorporation. George Wirt Bowman, Thomas J. Burke, and John D. Woodruff are incorporators and directors. The objects of the company are to operate a railway with steam or other power through Denver, Highlands, and Barnum.

HILLSBORO, ILL.—The Springfield and Southern Railway has received right of way through this county. Chief Engineer Davies has completed the work of preparing the profiles taken from the recent survey, and he is now ready to make a report as to estimates and details for constructing the road.

LITTLE ROCK, ARK.—The Street Railway Company will make considerable extensions. Address R. W. Worthen.

MOLINE, ILL.—A survey made under the auspices of the Moline Business Association, was completed October 25, for a lateral canal around the upper rapids of the Mississippi, beginning at the head of the rapids just about Rapids City and running through Rapids City, Hampton, and Watertown to Moline, where it would strike the Government water-power pool, a lock at the lower end of which would secure entrance to the main branch of the river at Rock Island.

BIDS OPENED.

CHAUTAUQUA LAKE, N. Y.—The contract for dredging the outlet of Chautauqua Lake has been let to Willard Johnson, Fulton, N. Y., at 21½ cents per cubic yard.

KALAMAZOO, MICH.—On October 24 bids for the construction of the proposed new water-works, well, and appurtenances were considered by City Council. They were as follows: Jaynes & Son, of Detroit, \$8,790; George C. Winslow, Kalamazoo, \$8,300; W. R. Coats, Kalamazoo, \$6,500. The committee recommended that the bid of W. R. Coats be accepted and the contract was awarded to him.

ALBANY, N. Y.—Contracts for improvements at Armory Hall have been awarded to T. E. Kerwin, plumber; James Feeney, carpenter, and P. J. Sweeney, steam-fitter.

INDIANAPOLIS, IND.—The following bids for Medina stone pavement on Washington Street, 26,666 square perches, were received by S. H. Shearer, City Civil Engineer, October 17:—

Walter S. Biglow, Buffalo, N. Y., pavement per lineal foot front on each side, \$26.40; curb, no bid.

T. B. McNaughton, Buffalo, N. Y., \$24.25; 88c.

Claffen Paving Co., Cleveland, O., \$23.63; 85c.

William F. Shanks, Louisville, Ky., \$25.40; 85c.

BALTIMORE, MD.—Contract for furnishing the material and doing the work on a retaining wall on the Falls Road from Maryland Avenue to Boundary Avenue, was awarded to Tracy & Nardin at \$12,680.83. The other bids were: Wm. Gilmor, \$13,470.95; Holloway & Fox, \$14,679.58; Conway & Bates, \$12,887.64.

LOS ANGELES, CAL.—Bids for constructing the city hall were opened October 8, by the Building Committee, as below:—

For carpenter-work—F. E. Greene, \$128,600; W. R. Phelps, \$116,150; A. F. Mackey, \$116,000; W. O. Burr, \$109,100; Albert Washbourne, \$99,888, and Robert Smiley, \$98,779.

For brick-work—James W. Wadsworth, \$97,171.

Plumbing, gas-fitting, and sewers—W. C. Furrey, \$6,000; William Henderson, \$5,350, and H. Williamson, San Francisco, \$4,344.

It was decided that the city should readvertise for bids for the erection of the building, complete in every respect, including sidewalks and curbing, and also to advertise for bids for the brick-work and stone-work in one bid, and the remainder of the work in another bid.

HELENA, ARK.—The bids for the construction of 8 miles of levee of the Cotton Belt District No. 1 that were filed the 15th of the month were opened October 17. The bid of Messrs. J. S. McTighe & Co., of Memphis, was the lowest and the contract was awarded to them. They contract to do the work at 17 cents per cubic yard. They begin work on the 27th of this month and guarantee to have the work completed by January 15, 1888.

PHILADELPHIA.—Bids were opened at the Board of Health office for plumbing work ordered done by the board on the premises Nos. 2511 to 2529 Gordon Street, and the following were received: Lewis O. Howell, Jr., \$952; John A. Fagan, \$392; the latter was awarded contract. For plumbing work required at 3303 Woodward Avenue, the bidders were Deckson & Dover, \$175; Lewis O. Howell, Jr., \$116, and John M. Sullivan, \$138. There was but one bid received for the plumbing work for the Municipal Hospital, 21st Street and Lehigh Avenue, and the Health Officer was directed to readvertise.

SAN DIEGO, CAL.—Bids for constructing the sewerage system were opened as below by the City Trustees October 13:—

The Pacific Bridge Company offered to dig trenches, etc., for 89½ cents per lineal foot and to lay pipes for 9 cents additional.

Alexander McBean would dig trenches, lay pipe, cement and back fill for 97 cents per lineal foot. Flush tank on Sixteenth Street, near L, \$1,450. Flush gate in reservoir, \$4,900. He will furnish all material except iron, and build inspection holes for \$7.50 each.

M. McDonald, of San Bernardino, offered to do the work with the exception of furnishing pipe and iron, and the building of manholes and lampholes, for \$133,000.

George H. Chapman's bid was: 155,000 feet of sewer, with trenches, 90 cents; flush tank, \$6,600.

The American Bridge Company offered to do the sewer work for 89 cents, and to construct the flush tank for \$7,000.

The bids were referred to the Sewer Committee, City Engineer and Superintendent of Streets.

MILWAUKEE, WIS.—The Board of Public Works October 25 awarded the contract to construct the sewer on Twenty-first Street to F. J. Foran, at \$1.69 per foot; also to Dan O'Driscoll, the contract for the construction of the sewer on Mitchell Street, at \$3.80 per foot.

DULUTH, MINN.—Contract for grading Second Street has been awarded to McLennan & Hannah, at \$7,134.75.

Bids for various work have been received by the Board of Public Works, as follows: grading Twelfth Avenue, east, McLean & McKenzie, \$9,134.25; J. S. Wolf & Co., \$6,885.50; Heney & Derby, \$6,637.50.

Sewer in Alley, J. S. Wolf & Co., \$18,681.50.

Sewer in Third Street, J. S. Wolf & Co., \$3,452.

Sewer in Alley, A. L. Warner, \$7,880; J. S. Wolf & Co., \$6,029.50.

The board have awarded the contracts to Heney & Derby and J. S. Wolf & Co.

GOVERNMENT WORK.

SYNOPSIS of bids for two fire-proof safes, with burglar-proof chests for Toledo, O., Post-Office, opened October 22, by the Supervising Architect:—

Mosler, Bowen & Co., for money order department, \$240; for city registry, \$215.

McNeale & Urban, \$207.50; \$186.50.

Marvin Safe Co., \$248; \$214.

Hall Safe and Lock Co., \$327.05; \$225.25.

Farrel & Co., \$246; \$193.75.

LEAVENWORTH, KAN.—Contract for the Government Building is awarded to W. T. Yoakum at \$31,800.

ST. AUGUSTINE, FLA.—Synopsis of bids for safe for Post-Office: Mosler, Bowen & Co., \$260; McNeale & Urban, \$330; Marvin Safe Co., \$310; Hall Safe and Lock Co., \$389; Herring & Co., \$350; Farrel & Co., \$310.

EL PASO, TEX.—One fire-proof safe with burglar-proof chest for Collector's Office: Mosler, Bowen & Co., \$510; McNeale & Urban, \$706; Marvin Safe Co., \$625; Hall Safe and Lock Co., \$999.25; Herring & Co., \$1,350; Farrel & Co., \$793.

COLUMBUS, O.—One shell safe for office of Collector of Internal Revenue: McNeale & Urban, \$214; Marvin Safe Co., \$248; Hall Safe and Lock Co., \$222.60; Farrel & Co., \$399.

One burglar-proof safe for Richmond, Va.: Mosler, Bowen & Co., \$355; McNeale & Urban, \$485; Marvin Safe Co., \$370; Hall S. & L. Co., \$543.73; York Safe and Lock Co., L. Wagner, agent, \$439; Farrel & Co., \$518.

One fire-proof safe and burglar-proof chest for money order division of Post-Office at Philadelphia, Pa.: Mosler, Bowen & Co., \$265; McNeale & Urban, \$265; Marvin Safe Co., \$360; Hall S. & L. Co., \$424.90; Farrel & Co., \$410.

One burglar-proof safe for Louisville, Ky.: Mosler, Bowen & Co., \$550; McNeale & Urban, \$657; Marvin Safe Co., \$690; Hall S. & L. Co., \$760.80; B. Hallman, Manager, \$598; Farrel & Co., \$737.

One fire-proof safe and burglar-proof chest for Internal Revenue Office, Custom House, etc., at Atlanta, Geo.: Mosler, Bowen & Co., \$340; McNeale & Urban, \$391; Marvin Safe Co., \$390; Hall Safe and Lock Co., \$624.85; Farrel & Co., \$449.

READING, PA.—On October 25 bids for constructing the foundation of the Government Building were opened as below: Frank Eben, \$12,000; Fredrick Eben, \$11,753; Richard G. Johnston, Trenton, \$17,780; L. H. Focht, Birdsboro, \$10,787; H. S. Hartman, Reading, \$10,480; Charles Reinert, Reading, \$9,365. George W. Garst is Superintendent.

SYNOPSIS of bids for repairs to Marine Hospital Building, Chelsea, Mass., opened October 12: James Fagan, Boston, Mass., \$11,495; complete in sixty days. Flanagan Bros., Boston, \$11,520. Fagan's bid was accepted.

BROOKLYN.—The following bids for excavating work at the new Federal building have been received by Mr. Guilfoyle, the Superintendent: John Cox & Co., \$1,484, and \$1.75 per cubic yard for extra work; Timothy C. Mayer, \$1,980, and 90 cents per cubic yard for extra work; Charles Lawrence, \$2,000, 75 cents per cubic yard for extra work; Michael Dalton, \$2,200, and \$1.25 per cubic yard for extra work; Daniel Gallagher, \$2,600, and \$1.25 per cubic yard for extra work; Patrick O'Hara, \$2,700, and \$1.20 per cubic yard for extra work; Charles Hart, \$2,900, and \$1.47 per cubic yard for extra work.

WASHINGTON, D. C.—Abstract of bids for improving North Capitol Street, from I to K Streets, opened by Colonel William Ludlow, Engineer Commissioner, September 30:—

Removing old material: old curb, at 8c. per lineal foot; cobble, rubble, flagging, stone, and bricks, etc., at 15c. per square yard.

Grading, at 25c. per cubic yard; hauling earth per 100 feet over first 200 feet, at 1c. per cubic yard; setting standard curb, at 18c. per lineal foot; resetting standard curb, at 12c. per lineal foot; setting special granite curb, at 40c. per lineal foot; constructing combination curb and gutter, at \$1.27 per lineal foot; laying brick sidewalk, at 28c. per square yard; laying coal-tar distillate, and asphalt pavement, at \$1.98 per square yard.

DETROIT, MICH.—Abstract of bids for metal work for Skilligalee Lighthouse, Mich., opened October 20 by Major S. M. Mansfield, Lighthouse Engineer:—

The Russel Wheel and Foundry Co., Detroit, \$1,560.

West Point Foundry Association, Cold Springs, N. Y., \$1,629.

H. A. Ramsay Engineering Works, Baltimore, Md., \$1,745.

John Cooper, Mount Vernon, O., \$3,490.

Robert Dunbar & Son, Buffalo, N. Y., \$7,000.

TOMPKINSVILLE, N. Y.—Abstract of bids for metal-work for Castle Hill Light Station, R. I., opened October 22:—

The H. A. Ramsay Engineering Works, Baltimore, Md., \$3,900.

West Point Foundry Association, Cold Spring, N. Y., \$4,100.

TOMPKINSVILLE, S. I.—The following bids for constructing a lighthouse at Castle Hill Station, R. I., were received by Major D. P. Heap, U. S. Engineers, October 20:—

William F. Wilber, Newport, R. I., \$8,600.

D. V. Howell, New York City, \$13,877.

Edward Murphy, New York City, \$16,380.

TOO LATE FOR CLASSIFICATION.

DERRY, PA.—Incorporated is the Salem Water Company, of Derry. P. N. Janeway, Edward Pitcairn, and others, incorporators.

SPARTANBURG, S. C.—The Spartansburg Water Company has been incorporated; capital stock, \$100,000. John F. Moffett, Henry C. Hodgkins, and others, incorporators.

GREEN BAY, WIS.—Our correspondent writes: "The city of Green Bay has taken no steps yet toward building an iron draw-bridge on Walnut Street bridge. The improvement is needed, and will, I think, be done during the coming winter; but before it is decided to do the work the matter will have to be submitted to a vote of the electors of the city."

PHILADELPHIA.—Messrs. I. H. Hathaway & Co., of 727 Walnut Street, this city, have been awarded the contract to build a bridge across the Wissahickon, at Springfield.

OAKLAND, CAL.—The contract for a bridge, costing \$45,000, to be built across the Umpqua River at Roseberg, has been awarded to the California Bridge Co., of this city.

SAN FRANCISCO, CAL.—The San Pedro Harbor, Dock and Land Company has been incorporated, with E. H. Pardee, Charles N. Fox, of Oakland, and others as a Board of Directors. The company propose to build a wharf and improve San Pedro Harbor.

SACRAMENTO, CAL.—The Board of Supervisors have awarded the contract for building a bridge over American River, mentioned elsewhere, to the California Bridge Company at \$34,697.

NEWPORT, KY.—It is reported that the contract to construct a bridge over the Ohio River here has been awarded to the Union Bridge Co., of New York, at \$1,500,000.

WATERVILLE, O.—The contract for the construction of a bridge over the Maumee River at this place has been awarded to Stephen Brosiguse.

EAU CLAIRE, WIS.—The city has voted for \$25,000 bridge bonds."

NEW ULM, MINN.—Bids are being received for the Brown County Court-House. Carl F. Struck, of Minneapolis, is the architect.

STILLWATER, MINN.—Main Street will be paved at a cost of \$14,763.

MINNEAPOLIS, MINN.—Bids have been opened for steam-heating in the Work-House extension, as follows: De Soto Boiler-Works, plant complete, \$2,335; J. M. Kelly & Co., boiler and connections, \$1,475; Porter Steam-Heating Co., plant complete, \$2,270; M. W. Glenn, boiler and connections, \$1,266; B. H. Shafer, boiler, \$1,000.

ST. PAUL, MINN.—Contracts awarded by the Board of Public Works: Grading Park Avenue and other streets, to William A. Davern, for \$15,250; grading Lafond Street, to William A. Davern, \$7,245; grading Delos Street, to McArthur Bros., \$3,000; grading Sibley Street, to James Forrestall, \$5,400; sewer on Iglehart Street from Louis to Farrington, to Patrick Doherty, \$1,367; sewer on Iglehart and Dale Streets, to Patrick Doherty, \$7,693.

The Board of Fire Commissioners has awarded contracts: Steam-heating plant, Central Fire Hall, \$1,950, to Thomas Davis; shops for repairs and storage to Rundle & King, \$2,500, and Commissioner Prendergast and Chief Black authorized to locate drive-wells and contract for cisterns, windmills and pumps for fire purposes at Merriam Park and Hamline.

PROPOSALS.

(Continued from page 608.)

OCTOBER 27, 1887.
SEALED PROPOSALS will be received at the Office of the Supervising Architect of the U. S. Treasury Department at Washington, D. C., and opened at 2 p. m. of the 30th day of November, 1887, for furnishing and putting in place complete the iron stairs, etc., of the Post-Office, etc., at Hannibal, Mo. Each proposal must be accompanied by a certified check for \$500, made payable to the order of the Treasurer of the United States. The right to reject any bids is reserved. The plans and specifications may be had and any information obtained by applying to this office or the office of the Superintendent, WILL. A. FRERET, Supervising Architect.

PROPOSALS.

TREASURY DEPARTMENT, U. S. Life-Saving Service, Washington, D. C., October 26, 1887. Sealed proposals will be received until 2 o'clock P. M. of Saturday, November 19, 1887, for the construction of a life-boat station at Galveston, near east end Galveston Island, Texas. Plans and specifications containing full information, and forms of proposals, can be obtained from the Superintendent of the Eighth Life-Saving District, Custom House, Galveston, Texas; Collector of Customs, New Orleans, La., Superintendent of Construction, Life-Saving Stations, No. 24 State Street, New York City, and upon application to this office. S. I. KIMBALL, General Superintendent. 23

CITY HALL.—Proposals will be received until November 4, for the construction of the superstructure of the City Hall Building in Omaha, Neb. Bids will be made on printed blanks furnished by the Board of Public Works, and to be accompanied with a certified check in the sum of \$1,000, as evidence of good faith. Address St. A. D. Balcombe, Chairman Board of Public Works, Omaha, Neb.

BRIDGES.—The Board of Commissioners of Defiance County, O., will receive proposals at the County Auditor's office, at Defiance, O., until November 22, for furnishing the necessary materials and building two bridges of iron, with two stone abutments each. The Clarksville across the St. Joe River in Milford Township, and the Arrowsmith bridge over Lost Creek in Farmer Township, Defiance County, O. Clarksville bridge to be of one span, 165 feet between masonry, and must have a roadway 18 feet wide in the clear, and to consist of one span; height of truss not less than 26 feet; capacity, 80 pounds per square foot of floor. Arrowsmith bridge to be of one span, 76 feet between masonry, and must have a roadway 16 feet wide in the clear; capacity, 80 pounds per square foot of floor. W. T. Hill, Auditor, Defiance, O.

PUMPING-ENGINES.—Proposals will be received at the City Engineer's Office, Minneapolis, Minn., until November 17, for two horizontal compound condensing pumping-engines, with a daily capacity of 15,000,000 gallons each; also for building and erecting a pumping-station near Shingle Creek; also for furnishing about 12,000 lineal feet of 30-inch cast-iron water-pipe. Specifications for pumping-engines and cast-iron pipe, and plans and specifications for the building can be seen at this office. Andrew Rinker, City Engineer, Minneapolis, Minn.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—b s, brown stone; br, brick; br st, brick store; h s dwel, brown-stone dwelling; apart house, apartment-house; ten, tenement; c, each; o, owner; a, architect; b, builder; fr, frame.

NEW YORK.

N w cor 89th and West End av, 10 br dws: cost, \$220,000; o, W E D Stokes; a, Jos H Taft.

N w cor 124th and 9th av, br warehouse: cost, \$12,000; o, Chas T Kendall; a, F T Camp.

E s Bergen av, 80 s Grove st, 6 fr dws: cost, \$12,000; o, Henry Schmidt; a, Arcander & Meyer.

143-45 E 24th st, br stable: cost, \$12,000; o, Solomon Wehrbach; a, Thayer & Robinson.

N w cor 10th av and 77th st, 4 br stores and flats; cost, \$84,000; o, Henry W Smith; a, G A Schellinger.

S s 137th, 109 e Rider av, br factory: cost, \$15,000; o, J L Mott Iron Works; a, A G Thomson.

411 W 37th, br flat: cost, \$19,000; o, Alexander Moore; a, Thom & Wilson.

5 Elizabeth, br flat: cost, \$16,500; o, Wolf Bauer; a, Herter Bros.

408 W 52d, br factory: cost, \$18,000; o, Louis Sier; a, Thom & Wilson.

S s 91st, 182 w 4th av, 3 br dws: cost, \$54,000; o, S Warshing and J Palmer; a, Jas Henderson.

ALTERATIONS—NEW YORK.

213-25 E 119th and 210 E 120th, br meat and ice house: cost, \$10,000; o, Richard Weber; a, Herman Bros.

310 E 82d, br factory, stable and dw; cost, \$7,000; o, Wm E Seitz; a, A H Blaubeinstein.

47 Gt Jones, br bldg: cost, \$6,000; o, Chas B Fitzpatrick; a, not given.

BROOKLYN.

No. 227-229 Central av, 2 fr dwells: cost, \$6,000; o, Jos Elaise; a, Chas Newmeyer.

N w cor McDougall st and Saratoga av, fr dwell: cost, \$5,000; o, Ma Mela Muller; a, E Schenck.

S s Clifton pl, 103 e Grand av, 3 brick dwells: cost, \$16,500; o, Jos I Kirby; a, Amzi Hill.

Vigilius, 40 w Bushwick av, 6 fr dwells: cost, \$16,800; o, Henry Meyer; a, H Vollweiler.

N s Bergen, 325 w Rockaway av, 6 fr dwells: cost, \$12,000; o, J P Purdy; a, Jas Cathcart.

N s Grand, 70 e Leonard, 2 br dwells: cost, \$14,000; o, Joseph Carney, Abram Cooke; a, F J Berlenbach.

S s Lafayette av, 95 w Lewis av, 2 br dwells: cost, \$10,000; o, J D Palmer; a, I D Reynolds.

S s Montgomery, 134 e 8th av, br dwell: cost, \$10,000; o, Geo A Price; a, C H P Gilbert.

S s Montgomery, 134 e 8th av, br dwell: cost, \$8,000; o, M R Starr; a, C H P Gilbert.

S s Montgomery, 112 e 8th av, br dwell: cost, \$9,500; o, Thos Van Loan; a, C H P Gilbert.

N s Herkimer, 325 w Nostand av, brick dwell: cost, \$10,000; o, I D Carpenter; a, Amzi Hill.

95 Mecker av, frame dwell: cost, \$5,000; o, Patrick O'Brien; a, Th Engelhardt.

Toutman, n s, 130 w Hamburg av, 3 story fr store and ten; cost, \$7,000; o and b, Louis Madn, 255 Throop av.

Ten Eyck, s s, 90 e Lorimer, two 3 story dwells: cost, total, \$10,000; o and b, T L Neff, 112½ Powers; a, Th Engelhardt.

Flushing av, n s, 113 e Morgan av, three 3 story fr tens; cost, each, \$3,500; o, Joseph Harte; b, F Harte.

57th, s s, 300 e 5th av, one 2 story fr dwell: cost, \$8,000; o, John Murphy.

Ocean pl, e s, 87 s Herkimer, four 3 story br tens; cost, each, \$4,500; o, Richard Robbins; a, W Godfrey; b, E K Robbins.

Gunther pl, w s, 87 s Herkimer, four 3 story br tens; cost, each, \$4,500; o and b, same as last.

North 2d, s e cor Lorimer, 4 story br store and tens; cost, \$11,000; o and b, Charles Sussieck; a, Th Engelhardt.

S w cor Flushing av and Adelphi, br dwell: cost, \$12,500; o, Ferguson & Thomas; a, W H Burhaus.

S s Grove, 95 e Central av, fr brewing bldg: cost, \$15,000; o, Ibert & Eppig; a, Th Engelhardt.

N s Oak, 520 e Franklin, br Home for Aged and Infirm; cost, \$12,000; o, Ladies' Benevolent Association of Greenpoint; a, as above.

N w cor Flushing and Evergreen av, 6 fr dwells and stores; cost, \$27,000; o, Leopold Michel; a, as above.

18 Quincy, br wagon bldg: cost, \$5,300; o, F Dresen & Co; a, W H Burhaus.

N s Greene, 20 w Patchen av, 4 br dwells: cost, \$18,400; o, James W Stewart; a, I D Reynolds.

N e cor Myrtle av and Navy, br ten; cost, \$18,000; o, Isaac Tyson; a, Carl & Eisenbach.

BROOKLYN—ALTERATIONS.

154 Sands, br factory: cost, \$15,000; o, Adams & Son; a, Parfit Bros.

N w cor S 11th and Broadway, br factory: cost, \$6,000; o, John M Loughlin; a, W H Gaylor.

LINCOLN, NEB.—St Mark's Lutheran Church; a, W Gray.

PEORIA, ILL.—First Presbyterian Church; cost, \$50,000.

ARKANSAS CITY, KAN.—Opera-house: cost, \$50,000; contract let.

NEW ORLEANS, LA.—The New Orleans Safe and Lock Co will build a factory at once. H Dudley Coleman is president.

PORTLAND, ORE.—Br bldg, First and A Streets; o, C H Dod.

MAYNARD, ILL.—Dwell; o, Mr Bullard.

QUINCY, ILL.—Bus blk; o, J H Decker; a, Tubbesing.

COUNCIL BLUFFS, IA.—6 dwells; b, J Cowino.

PENSACOLA, FLA.—Public bldg: cost, \$35,000; address city clerk.

HORTON, KAN.—Br school to be built.

MEADECENTRE, KAN.—School bldg: cost, \$11,000.

HOUGHTON, MICH.—Bldg for Mining School; a, Scott & Co, Detroit, Mich.

JAMESTOWN, R. I.—New hotel bldg; a, Maxim & Co, of Westerly; o, New Hotel Co.

READING, PA.—Hotel; cost, \$200,000; on the Central Hotel site.

AGNEW'S STATION, CAL.—Hospital bldgs for insane; a, Jacob Lenzer & Son, San Jose, Cal.

WORCESTER, MASS.—In progress: bldg for Clark University; a, Stephen C Earle of Worcester.

KEYTESVILLE, MO.—Br schoolhouse. Address M H Holcomb.

BOSTON.—Hamblin, near Dorrance, br engine-house: cost, \$8,000; o, Charleston Gas Co; a, Geo E Morrill; b, Donovan & Brock.

Warren bridge, br boiler-house: cost, \$19,000; o, Fitchburg R R; a, E K Turan; b, F Johnson.

Stamford, cor Lyman, br tens; cost, \$17,000; o, Hubert Daly; a, E N Boyden; b, Murphy Bros.

Stamford, near Lyman, br dwell: cost, \$8,000; o, Katharine A Holden; a, W H Besarick; b, J H Coon.

112 Norfolk av, brick warehouse: cost, \$11,000; o, Pierson Cordage Co; o, J H Hosmer; b, Lamming & Son.

428 Marlborough, br dwell: cost, \$9,000; o, George Meatland, Jr; a, O F Smith; b, C A Dodge.

449 Marlborough, br dwell: cost, \$9,000; o, a, and b, same as above.

451 Marlborough, br dwell: cost, \$9,000; o, a, and b, same as above.

453 Marlborough, br dwell: cost, \$9,000; o, a, and b, same as above.

457 Marlborough, br dwell: cost, \$9,000; o, a, and b, same as ab ve.

12 Sewall pl, br dwell: cost, \$8,000; o, Mary H Hyams; a, Jacob Goldsmith; b, Thomas R White.

1464 Tremont, br dwell: cost, \$10,000; o, a, and b, same as above.

1466 Tremont, br dwell: cost, \$10,000; o, Mary H Hyams; a, J Goldsmith; b, Thomas R White.

Elm Hill av, br dwell: cost, \$14,000; o, John Carr; a, J H Besarick; b, S W Chesley & Co.

Carruth, near Ashmont, br dwell: cost, \$7,000; o, Henry C Shoal; a, Appleton & Stephenson; b, E F Moulton.

444 Main, br dwell: cost, \$8,000; o, J M Lydston; a, — Darling; b, H H Soule.

Beverly, br freight-house: cost, \$10,000; o, Fitchburg R R; a, E K Turner; b, A R Hulbert.

PROVIDENCE, R. I.—Eighth, 4 dwells; o, J T Cottrell; b, S B Peck.

High and Bridgman, fr office bldg; o, H T Grant.

Governor, e side, dwell: cost, \$9,000; o, C P Robinson; a, F J Sawtelle; b, A A Gray.

17 buildings costing less than \$7,000 each.

CHICOPPEE, MASS.—Br and fr church: cost, \$8,000; o, Central Baptist Society; a, George Kilburn; b, contract not let.

SPRINGFIELD, MASS.—Crescent hill (city), granite and shingle dwell: cost, \$25,000; o, A L Fennessey; a, Richmond and Seabury; m, D J Curtis; c, N L Byron.

Parish house, b s and open timber work with plaster between; cost, \$12,000; o, Christ Church; a, Hartwell & Richardson, Boston, Mass; m, P Beston; c, C L Shaw.

NEWPORT, R. I.—Bellevue av, fr and stone cottage; o, Mr H N Pond; a and b, J D Johnson.

OTTUMWA, IOWA.—New depot in progress here.

TORONTO, ONT.—Br dwell at Rose Hill Reservoir; o, The City; contracts let.

GREYCOURT, N. J.—A new depot will be built here by the Erie RR.

FERDALE, CAL.—A \$7,000 school house here.

MINNEAPOLIS, MINN.—Fifth, bet Nicollet and Hennepin avs, bus block: cost, \$200,000; steam heat, elevator, etc; o, R S Goodfellow & Co; a, Orif Bros.

BOSTON, MASS.—Argyle, fr dwell: o, John G Phillips; b, F M Severance; a, Edwin J Lewis, Jr.

ASHMONT, MASS.—Alban, fr dwell: o, James C Elms, Jr; b, Wm O White; a, Edwin J Lewis, Jr.

DORCHESTER, MASS.—King, fr dwell: o, Miss M Mason; b, P M Severance; a, Edwin J Lewis, Jr.

WARE, MASS.—2 story br mill, 70x350; o, Otis Company.

2 story br machine shop, 45x99; o, Otis Company.

BELCHERTOWN, MASS.—Hotel in process of erection.

LANCASTER, PA.—A market house to cost \$25,000 will be built at this place. C Emilen Urban is the architect. The work has not yet been let.

ST. LOUIS, MO.—Finney and Sarah av, 2 br dwells: cost, \$7,200; o, L C Hudson; b, J H Dunlap.

21st and Herbert, br rphan house: cost, \$9,000; o, Sisters of the Poor; a, J H McNamara; b, M Britt

10th and Locust, br warehouse: cost, \$22,000; o, Simmonds Hardware Co; b, B Cheesman.

13th and Cherokee, br malt house: cost, \$15,000; o, Wm J Lemp; b, sub let.

10th and Market, br store: cost, \$7,000; o, H McNichols; a, E Mortimer; b, J Martin.

18th and Cass av, br storage house: cost, \$12,000; o, Brinkwirth & Walker; a, E Jungenfeld & Co; b, sub let.

10th and Arsenal, br storage house: cost, \$50,000; o, Anheuser & Busch; a and b, same as last.

READING, PA.—Elm and 6th, br bldg: cost, \$9,000; o, Steam-Heating Company; b, H A Tyson.

Canal, 4 story br warehouse and paper mill: cost, \$10,000; o, Reading Paper Mill Company; b, L Tocht.

P O'Reilly's estate has now under roof twelve fine brick dwellings, costing in all about \$50,000, which he will finish this season; will have all the improvements complete; a, W Fink.

BALTIMORE, MD.—Trout near Lombard, 3-story br bldg; o, H Ladensack.

Penn av and Smith, 3-story br bldg; o, Henry Werner.

Montgomery, near Sharp, 3-story br bldg; o, A McElinoyt.

9 br bldgs.

NEW HAVEN, CONN.—Dwell on Edwards st; o, M R Enscoe.

BRIDGEPORT, CONN.—Harroll av and Catharine st, ten; o, Wm Morrissey.

Br flats on Thomas st; o, Edward W Marsh; c, H B Beardsley; cost, \$6,500.

MERIDEN, CONN.—Dwell on Broad st; cost, \$8,000; o, G M Curtis; a, Fuller & Wheeler, Albany.

Bond Harness Co., Britannia st; cost, \$10,000; a, H M Jones; b, G H Gladrim.

100 F bldg on Broad st; cost, \$22,000; a, H M Jones; m, H W Lines & Co.

Blk, West Main st; cost, \$12,000; o, Michael Keating; a, H M Jones; m, H W Little & Co.

State Reform School bldg on Chestnut st; cost, \$30,000; a, E C Gardner, of Springfield; m, H. W. Little & Co.

HARTFORD, CONN.—Factory on Summer Place; o, E J Hoadley; b, Watson Tryon.

4 dwells on Albany av; cost, \$14,000; o, Parks & Sarge; b, Geo E Denison.

PASADENA, CAL.—Episcopal Church; cost, \$35,000.

OIL CITY, PA.—Roman Catholic Church; cost, \$31,000.

OLEAN, PA.—Episcopal Church; cost, \$40,000.

CASTLETON, N Y.—Reformed Church; cost, \$12,000.

ELMWOOD, O.—St Matthews' Episcopal Church in progress.

SPRINGFIELD, MASS.—First Baptist Church; a, L B Volk & Son, N Y City.

ONEONTA, N Y.—Presbyterian Church.

CHESTERTOWN, MD.—Methodist Church; cost, \$25,000.

ATCHISON, KAN.—English Lutheran Church.

LINCOLN, NEB.—Church of Holy Trinity edifice; cost, \$35,000.

NAUGATUCK, CONN.—Bus block; cost, \$13,000; o, E C Barnum; a, R W Hill, of Waterbury.

FRENCH LICK SPRINGS, KY.—Hotel building. Address John C Howard, of Building Committee.

WINCHESTER, KY.—Kentucky Wesleyan College bldg.

NEW HAVEN, CONN.—Buildings in progress:

President W W Converse's house: cost about \$25,000.

Wm F Downes res on Whitney av, between Edwards and Lawrence sts.

Two new residences on Grove st near Grove Hall, erected by Chas H Webb.

Mr Wm A Lincoln is erecting a cluster of houses on Jackson st, Fair Haven, in the neighborhood of the Shore Line Railroad.

A dwell is being erected on Orange street between Bishop and Edwards sts for Mr J D Beecher, and will cost about \$18,000.

YOUNGSTOWN, O.—The A Y & P R R Co are going to erect a handsome depot here to cost not less than \$10,000. Work will be commenced at once.

SPRINGFIELD.—Off Pine, 4 ten br block; cost, \$8,000; o, — Webster; a, F S Newman; b, D J Curtis.

NEWPORT, R. I.—Swedish church; Pastor, Rev Mr Hanson.

HADDONFIELD, N. J.—A Roman Catholic Church will be built here. Address Rev John M Murphy.

RHINELANDER, WIS.—Johnson Bros & Co. will rebuild their wagon factory and machine shops.

NORTH ATHENS (or Athens), TENN.—Hotel, br, stone and slate; cost, \$40,000; Athens Land and Mining Company; a, Thomas C Veall.

SPRINGFIELD, MASS.—Maple, alt on br and fr house; cost, \$15,000; o, P P Kellogg; a, Richmond & Seabury; b, L H Scott and J S Sanderson.

HOLYOKE, MASS.—Mill: cost, \$12,000; o, Conn River Lumber Co; o, Otto Swatthen; b, not known.

Alt high school; cost, \$5,000; a, J H Clough; b, not known.

INDIANAPOLIS, IND.—N Delaware, br bld; cost, \$7,000; o, Henry Coburn; a, L H Gibson; b, M K Fotout.

N Delaware, br bldg; cost, \$6,000; o, C E Kruly; a, L H Gibson; b, Shover & Christian.

HUTCHINSON, KAN.—Nothing to report over \$7,000.

FREETOWN, MASS.—At a town meeting held in Freetown Saturday it was voted to build a new town hall.

JACKSON, TENN.—A spoke factory will b. built here.

CHATTANOOGA, TENN.—A \$150,000 hotel will be built on Lookout Mountain.

STAMFORD, CONN.—Bus block, Pacific st. o, John Ryle; contract let; m, Daniel O'Connell.

Bus block, Pacific st; o, C F Miller, m, Edward Willett.

Bldg, Main and Pacific sts; o, Mr Pitts; b, Eugene Mead and S A Gregory & Co.

Bus bldg, Main st; o, S Adams; a, Henry Woodman; cost, \$17,000.

EAST HARTFORD, CONN.—Dw; o, Benjamin Dart; b, J M Bragg.

GREENWICH, CONN.—Village: o, Dr L Mason; a, W M Coats, of Brooklyn, N Y.

STAFFORD, CONN.—Mineral Springs Co bldg; b, P B Johnson, steam heat.

SELMA, ALA.—New school bldg: address Mayor Haas.

WORCESTER, MASS.—Nothing to report this week over \$7,000.

MILWAUKEE.—The Montreal River Co are erecting a large saw-mill to cut 100,000 feet of lumber per day at Gile, on the Mil, L S & W R'way, in the town of Vaughn, Ashland County, Michigan.

SPRINGFIELD, MASS.—Mulberry st, fr dw: cost, \$12,000; o, H H Bowman and T W Ellis; a, Otto & Bellinger; b, J D Curtis, mason; Stuart, carpenter.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.
NUMBER 23.

PUBLISHED EVERY SATURDAY.

NEW YORK, NOVEMBER 5, 1887.

LONDON, NOVEMBER 19, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 94 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 20, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5. The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

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LINING AN AQUEDUCT WITH LEAD.

THE aqueduct of Arcueil, which brings the waters of the Vanne to Paris, giving a daily supply of about 110,000 cubic metres, has for some time been a source of anxiety, owing to the fact that numerous small fissures had formed in it, the leakage from which endangered the foundations. In the early part of this year M. Humblot, the Chief Engineer of the Service, decided to stop this leaking by lining the interior of the aqueduct with lead for a length of 690 metres, and this has been done.

The sheets of lead used for this purpose are two millimetres thick and measure 4.8x2 metres. They are placed so as to overlap and are molded to the interior of the tube, which is circular and 2.10 metres in diameter. The upper edges of the sheets are 0.10 above the surface of the water in the duct. This has proved effectual in stopping all leaks. The total cost of the work was 52,500 francs. The question as to whether this mode of treating the duct would give rise to danger of lead-poisoning on the part of those using the water was a very interesting one.

The French chemists consulted on the subject were of the opinion that the amount of lead taken up by the comparatively pure water of the Vanne, flowing in an almost constant stream through the tube, would be so small as not to be a source of danger, but M. Humblot decided, as an additional precaution, to cover the inner surface of the lead sheathing with a thin layer of Portland cement.

Dr. O. du Mesnil, in a paper on this subject in the *Annales d'Hygiene* for October, 1877, from which the above data are taken, states that after the completion of the work in July last careful tests of the water passed through the tube were made by a competent chemist, M. Schutzenberger, with the result that he was unable to detect any appreciable quantity of lead in 50 litres of such water.

The expedient adopted appears, therefore, to have been entirely successful up to the present time. The results as determined two or three years hence will be very interesting, for there is room for doubt as to the expediency of the Portland cement lining of the lead with reference to the production of erosion of the metal surface, and this trial is on such a large scale that it will probably settle the question.

DESTRUCTION OF A WATER-TOWER AT FRANKLIN, MASS.

ENGINEERS and others connected with water-works, especially those in which an elevated tank is used for a reservoir, will be much interested in the account on another page of the destruction of such a tank which occurred October 27 last at Franklin, Mass. The description was written by a representative of this journal who visited the scene of the accident very soon after its occurrence, and the illustrations are from sketches and photographs made by him on the spot.

What caused the disaster is not definitely known, but we are inclined to the opinion that the weight of water in the tank, which was being filled for the first time after being raised as described, compressed the green masonry and blocking on which the tank rested.

This settlement broke the rising pipe, probably in the bell of the elbow at the bottom, shown in the sketch, which was afterward found to be frac-

tured, and which would naturally be the part most strained by it.

This would account for the instant loss of about forty pounds of pressure at the pump, and the water from the tank and from the pump, until it was stopped, would rush out into the masonry chamber. If its impetus was not sufficient to destroy the green walls, with the great superincumbent weight upon them, it would very soon burst them by its pressure, as the only door leading from the chamber was closed.

With the destruction of the walls the tank of course would fall and be violently ruptured on striking the ground by what water remained in it, for not half of the water could have run out before the walls burst, if this theory is correct.

A sample of the plate-iron obtained from the superintendent of the works is somewhat laminated and crystalline, but is perhaps good enough for tank-iron, although we may investigate that point further. The tensile strain on the perpendicular joints of the lower sheets is much higher than we should consider at all safe, as may easily be calculated from the data given, but it is still so far from causing rupture that we are not inclined to consider that the proximate cause of the disaster.

By a curious fatality, another water-tank, erected and owned by the same party, burst on the same day in Seneca Falls, N. Y.

We have sent another representative to that place, and give our readers his preliminary report elsewhere in this issue. We expect to give more detailed information next week, and until then we shall postpone further comment.

THE last number of the *Gesundheits Ingenieur* contains a paper by Professor Dobrowslawin, of St. Petersburg, on the comparative use of gas and electricity for lighting theatres. Referring to the interesting experiments made by Professor Pettenkofer and Dr. Renk, Professor Dobrowslawin, with the assistance of Drs. Kowolkowsky and Bosaroff, made, last February, during the three days' carnival at St. Petersburg, when the largest crowds fill the theatres, experiments on the temperature and ventilation of the "Grosse" and "Alexander" theatres, lighted with gas, and the "Mariar" theatre, lighted with electricity. These three theatres gave, each, two performances daily, and each held about 1,600 people. The thermometers were so placed as to be on a level with the audience. The carbonic acid was determined by the Pettenkofer method. As every theatregoer knows, the temperature falls between the acts, and it was found that the temperature in the galleries did not fall as rapidly as in the parterre. As a result, the Professor thinks that people seated in the parterre are more apt to take a cold than those in the upper parts of the house. The highest degree of temperature by electric-lighting was 25° C., and with gas 33° C. The Professor does not think that the difference of air is noticeable with either kind of lighting. Finally, the Professor concludes that electricity is far superior to gas from the standpoint of health.

THE BOOM AT LOS ANGELES, CAL.

AS EVIDENCE of the large ideas now prevailing in Los Angeles, Cal., we find a description in the *Express* of that city of a proposed scheme of sewerage involving the construction of 200 miles of sewers at an estimated cost of \$2,000,000.

At a point eight miles from the city 6,000 acres of land are offered the city for use, without cost, as a sewage-farm, with a guarantee of \$100,000 profit from its sale after development. This portion of the line will require some 8,000 feet of tunneling through the hills. We hope this enthusiastic promoter may not be disappointed in his anticipated profits, and it is possible that in a country where irrigation is essential to success in agricultural matters his expectations may be well founded. It may be well to remember that the balance is almost always on the other side of the ledger. As Mr. Rudolph Hering has been called upon to report upon the plans, they will doubtless be thoroughly sifted before being put into execution. We shall watch further developments with interest.

CINCINNATI'S WATER-SUPPLY AND TYPHOID FEVER.

THE old story of typhoid and malarial fevers from impure water is being retold just now in

the most prominent men in the profession, yet he has died comparatively a poor man, and many of his friends think his claim against the United States Government for extra professional services should be pushed. This claim is based on the fact that Mr. Walter was employed for one specific work, and while in Washington designed and executed the other Government work, for which he never received one cent. This claim amounts with interest to the sum of \$113,000, and it has been favorably acted on by the Commissioners of Claims at Washington.

Mr. Walter has been for so long an honored member of the architectural profession of the country, enjoying a great reputation for his work, that it seems to us that the American Institute of Architects should appoint a committee to inquire into this claim, and having satisfied themselves of its justice, should then take steps to secure its payment by the United States Government as a just debt.

THE meeting of the American Society of Civil Engineers this week was of more than usual interest, the feature being Mr. Buck's paper describing the work of

and that in its columns was the entire feasibility of heating by steam from the locomotive first demonstrated.

The Emerson system has been adopted by the Atchison, Topeka and Santa Fe Railroad, and its cars are being fitted therewith as rapidly as possible.

The Gold system has been adopted for all cars on the Manhattan Elevated, the Suburban Rapid Transit, the Inter State Rapid Transit, the Hoboken Cable Railway, and the Providence, Warren and Bristol. Part of the cars on the Boston and Providence are being equipped with it, and orders for equipment have been received from the Long Island Railroad and the Central Railroad of New Jersey.

The Martin Anti-Fire Car-Heater Company has made a contract with the New York Central Railroad covering their entire system.

The Safety Car Heating and Lighting Company have received orders from the New York and New England Railroad for their apparatus for thirteen cars, and this road has concluded to adopt it for their passenger system. In addition, the Northern Pacific has ordered it for fifteen cars, the Wagner Palace-Car Company for twenty, the



RESIDENCE OF E. W. DAVIS, ESQ., NARRAGANSETT PIER, R. I.—BRUCE PRICE, ARCHITECT

press dispatches from Cincinnati with unusual emphasis. This is attributed by the Health Officer, Dr. Stanton, to impurities in the water-supply, which, as our readers know, is taken from a point on the Ohio River which receives the surface wash from several miles of thickly-peopled country and is said to be liable, through eddies, to be sometimes contaminated by the city sewage. This state of things is aggravated just now by a long season of low water, but it is only a question of time when the intake of the water-works will have to be moved to some other point.

THE LATE DR. THOMAS U. WALTER.

WE elsewhere give a brief account of the career of the late Dr. Thomas U. Walter, until recently the active President of the American Institute of Architects. It is a fit time to call the attention of the institute to a matter in which Mr. Walter's Philadelphia associates are deeply interested—namely, his claim against the United States Government for extra services. We are advised from Philadelphia that although Mr. Walter has been one of

replacing the stone towers by iron ones at the Niagara River Suspension Bridge, an abstract of which we give elsewhere in this issue. A pleasant incident was the tribute by Mr. Theodore Cooper, a specialist in the same branch of engineering as is Mr. Buck. He expressed his appreciation of the magnitude and difficulty of the unique work performed, the skill with which it had been done, and the straightforward modesty with which it had been described, so as to make it appear a very simple matter after all, which sentiment elicited enthusiastic applause. Mr. Cooper also alluded to the fact that showy but comparatively simple engineering feats were heralded through the daily press from one end of the land to the other, while this work of Mr. Buck's, unprecedented both in its magnitude and its methods, had received no mention.

CAR-HEATING FROM LOCOMOTIVE.

THE following items will be found of much interest, as showing what is being done to supply a just and widespread public demand for safety in winter traveling.

It will be remembered that it is now nearly six years since this journal first advocated this much-needed reform,

Chicago and North-western for eleven, and the Delaware and Hudson Company for eight, and a number of others have given sample orders.

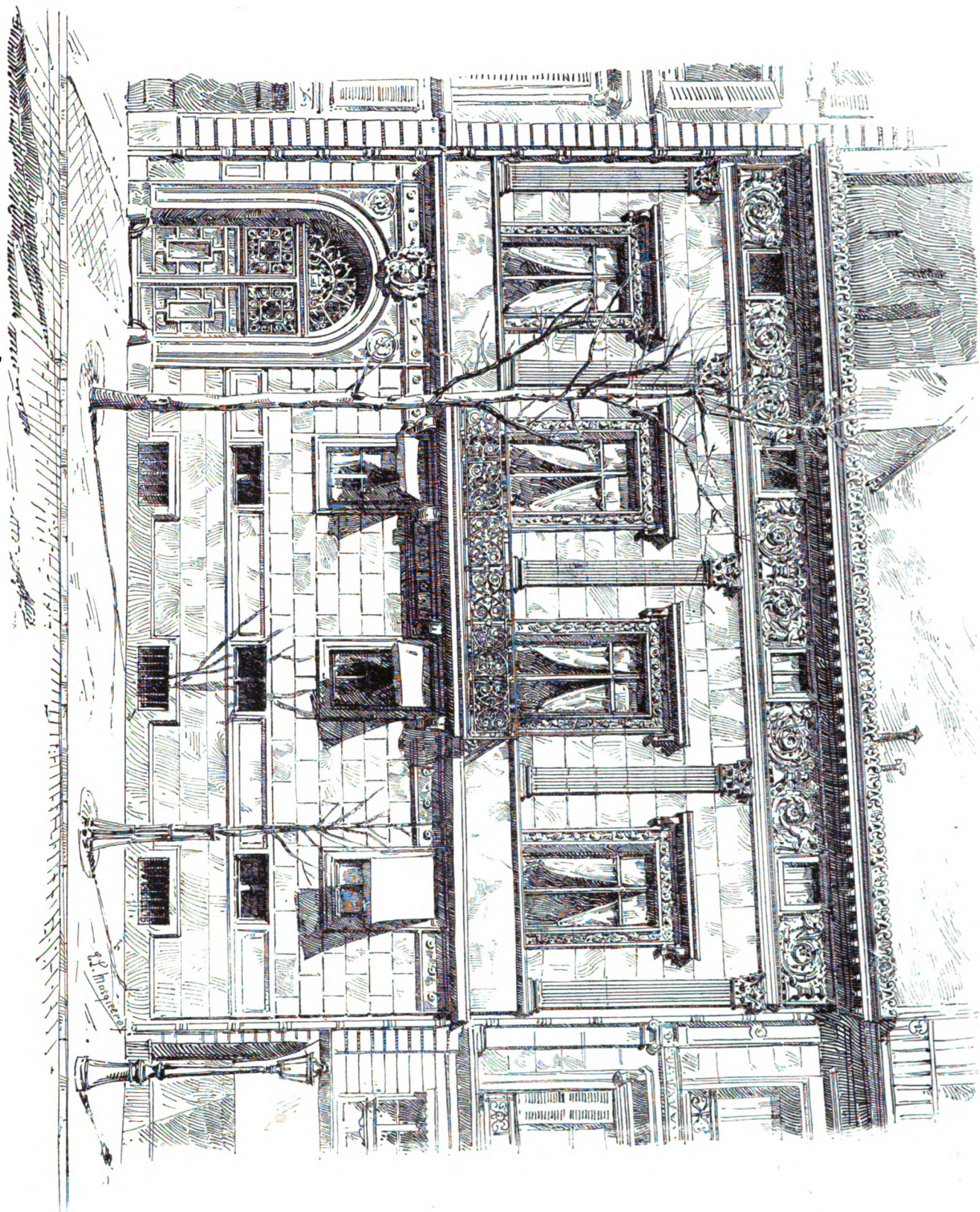
We shall be glad to inform our readers, from time to time, of any other railroads whose managers avail themselves of any one of the several systems of car-heating from locomotive now on the market.

A REPORT of an unusual and very pleasant incident reaches us from England. It is announced, in connection with the shocking accident that happened, owing to the negligence of the driver and stoker of the train on the Manchester and Sheffield Railway, by which the company have become liable for a large amount, owing to loss of life, that the workmen in the company's employ have offered to forego one week's wages towards the expenses. It should be added that the company is not a prosperous one.

OUR ARCHITECTURAL ILLUSTRATIONS.

HOTEL POURTALES, PARIS, FRANCE.

RESIDENCE OF E. W. DAVIS, ESQ., NARRAGANSETT PIER, R. I.



THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

HOTEL POURTALES. PARIS, FRANCE.

THE TRINIDAD PITCH LAKE.

THE control of this celebrated deposit of bitumen seems to have passed into the hands of Mr. Barber, of the Barber Asphalt Paving Company, and Mr. Greig, of London, under the style of the New York and Trinidad Asphalt Company, they having the sole right to export for a period of fourteen years on payment of an export duty of 6s. 8d. (£1.60) per ton, which shall produce a minimum revenue of £10,000 per annum. And it is further provided, that in case the export duty produces an aggregate of £168,000 during the fourteen years, the lease shall be renewed for seven additional years.

It was proposed to throw the exportation open to all on payment of the export duty, but, as noted, this was not done. Excepting a subscription of \$500 towards the Victoria Institute by the gentlemen obtaining the concession, no reason is given for the change in the plan.

It is probable that most of the large users of bitumen have made arrangements for this supply with the New York and Trinidad Company, because the annual purchasers of only 25,000 tons of bitumen, out of the 180,000 tons represented, objected to the contract.

UNWISE ECONOMY IN THE CITY OF LONDON
—A LARGE TRACTION ROPE.

(London Correspondence.)

THE economists of the Corporation of the City of London have just scored a success in the shape of a resolution which does them very little credit. At a meeting of the members of the Corporation it was decided, by a majority of three votes out of 172, that the post of City Architect, vacated by the decease of Sir Horace Jones, should not be filled, but that a surveyor should be engaged at a yearly salary of £800 (\$3,840), whom they considered would be competent to give attention to the general and minor details of architecture. In the event of any large public work outside aid could be sought, the remuneration being by commission. Notice was given of a motion to rescind this resolution at the next meeting, on the ground of surprise and the fact that eighty-three Aldermen did not vote. It remains to be seen whether this backward step will be confirmed. The idea of the economists is apparently that all the public buildings that are necessary in the city have been erected, and that therefore an annual saving of £1,000 (\$4,800), which would result from this change, would be justifiable. They have, however, lost sight of such works as the new Criminal Courts, the approaches to the Tower Bridge, and other imminent changes.

If the temporary triumph of these cheese-paring gentry is confirmed, we shall probably next hear of Colonel Haywood being deposed from his position as City Engineer, on the ground that the works of paving and drainage in the city have now been carried out and that necessary repairs could be effected by the means of ordinary builders and plumbers. However, the general body of members of the corporation have generally been credited with more sense than is indicated by this foolish policy.

The traction rope destined for use in the new cable tramway in Birmingham has just been completed and delivered by the makers, J. & E. Wright, of Birmingham. It consists of two coils, each two miles in length. The circumference is $3\frac{3}{4}$ inches, and the breaking strain 33 tons. The ropes are constructed of six strands, each strand of 19 wires. It is stated to be one of the largest wire ropes yet made by any firm.

The foundation stone of Liverpool University College has just been laid by the Mayor. In connection with this college there is a technical department, for which Mr. Thomas Harrison, of Liverpool, has endowed an Engineering Chair with £10,000 (\$48,000), and Sir A. D. Walker £20,000. No other town in Great Britain has a chair that has such magnificent gifts made by local men, or otherwise, towards technical education.

IRRIGATION IN SOUTH AFRICA.

SOUTH AFRICA is in general an arid country. The Boers, and the natives before them, practiced irrigation in a small way, but no large work was undertaken until Mr. John George Gamble, M. I. C. E., built a reservoir in the Northern Karroo, known as Van Wyk's Vley. This reservoir has a catchment area of 460 square miles, on which the annual rainfall was only six inches. To take advantage of a natural valley for an overflow, the reservoir embankment, which is of earth-work with a puddle-core, was raised so that the capacity of the reservoir is 35,000 million gallons, or equal to a 5-inch run-off from the whole

catchment area, more, it was thought, than is likely to be gathered while the reservoir is used for irrigation, unless several wet years occur in succession. The earth-work amounted to 80,000 cubic yards, and is faced with 12-inch pitching on 18 inches of broken stone, this depth being taken to prevent crabs working into and through the bank. The supply-pipes are taken through a masonry culvert sunk in the solid shale on one side of the valley, the culvert being plugged with Portland cement concrete from the valve-tower to past the puddle core. The total cost, without land compensation, was £18,000.

No irrigation was attempted in 1884, the first year after completing the dam, and in 1885 only twenty acres were cultivated experimentally, but the amount of land under irrigation has grown very fast, and where formerly but a few sheep could find pasture large numbers of farms are congregated, with thousands of sheep and cattle; and as 100,000 acres are available for irrigation a township will be laid out there. The water drawing for this season's crop seems to have very small effect on the water which has accumulated, and there is a call for additional reservoirs in that part of the Cape Colony.

As South Africa has, for a long time before the discovery of gold, imported grain and flour, the necessities of the gold-diggers, in addition to those of the Boers, will doubtless furnish a market for the produce of all the land that can be irrigated.

FAILURE OF A STAND-PIPE AT SENECA
FALLS, N. Y.

OUR representative sent specially to Seneca Falls to report on this disaster sends the following preliminary report, which we hope to supplement by further details in our next issue.

Thursday, October 27, at 3 P. M., the large stand-pipe maintaining head for the public water-supply of the town of Seneca Falls, N. Y., was destroyed by bursting. Our special survey and investigation at the scene of the disaster has developed all the facts and conditions necessary for its presentation.

The structure was a simple steel cylinder 30 feet in diameter by 130 feet high, without a suspicion of braces, reinforcements, guys or anchorage, made of boiler-plates $\frac{1}{4}$ -inch thick at top increasing to $\frac{3}{8}$ -inch at base, riveted to flanged bottom-plates and erected like a tall cheese-box, on a platform a foot or two greater in diameter, made up of three courses of rubble masonry; the lower two laid up dry, the top course and a 3-inch bed asserted to have been laid in Rosendale cement. This was the entire structure, a 12-inch hole in bottom plate serving as inlet and

feet above surface of ground there. Had the disaster occurred, as it well might have chanced, in a thickly-built neighborhood, the loss of property would greatly have exceeded the \$20,000 now estimated, and have been accompanied by loss of many lives.

The detailed description of materials, fractures, workmanship, etc., will be more intelligible when accompanied by the drawings of tower, map, and location of fragments, sketches of dismembered sections, fractures, etc., which are in preparation for our next issue.

This stand-pipe was built by contractor R. F. Hawkins, Springfield, Mass., for George H. Norman, Boston, Mass., who owns and maintains the water-works plant and receives payment from the town for its use.

DESTRUCTION OF A WATER-TOWER AT
FRANKLIN, MASS.

THIS steady-going town of 5,000 inhabitants is in Norfolk County, twenty-eight miles from Boston on the New York and New England Railroad, and is supplied with gas, water, and electric-lights. Straw works and shoddy mills are the chief industries of the place, and the Dean Academy furnishes the largest and most imposing building. Water-works were built in 1884 by George H. Norman, Esq., who is the principal stockholder in the Franklin Water Co. Water is taken from a well by three Knowles pumps and forced through cement-lined mains to a tank, built by the Whittier Machine Co., of Boston, forty feet in diameter, which before the recent alterations rose thirty-five feet above the hill on which it stood, this hill in turn being about 150 feet above the pumps.

The pressure on the mains having proved too light for fire service, the company decided to raise the tank forty-five feet. The work of raising and of building brick walls to sustain the tank in its new location was begun about eight weeks ago, and went on steadily and successfully until the morning of Thursday, October 27, when at 2:10 A. M. the structure fell and now lies a complete wreck. Briefly stated, the conditions at the instant the accident took place were as follows, as nearly as can be learned from inspection and inquiry on the spot. The tank was resting on the outer walls, which were sixteen inches thick, except at the bottom, where they were three feet in thickness, these walls forming a cylinder thirty-six feet outside diameter, with sixteen pilasters projecting four inches from the walls; it was resting on the inner walls, which were twelve inches thick, forming a cylinder twelve feet in diameter, and it was resting also on the jack-screws and blocking, which were as they had been for the previous three weeks—that is, with a slight strain upon the screws. The tank was held at the top by four wire-rope guys. There was about twenty-five feet



outlet, and the overflow gushing over the upper edges at will.

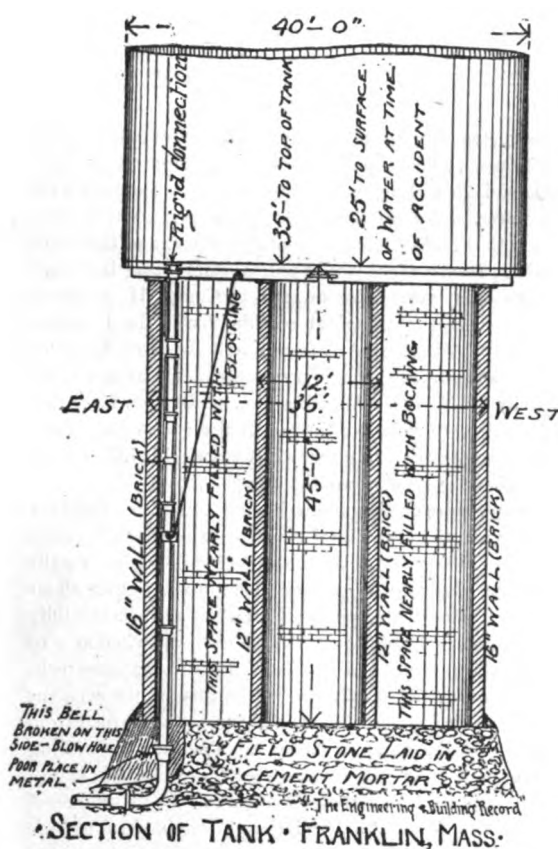
The collapse has been absolute, and a more complete wreck is unimaginable, the sections and fragments shattered, twisted, and hurled in great masses up to 175 feet away. There was no wind when the burst occurred, and an eye-witness says the explosion was followed by a gush of water on the north-west side (nearest him), 8 feet from the bottom, and then the slow swaying and fall of the upper part of the cylinder. A section of 90 feet of the top of the cylinder was cut off and thrown out so that the nearest part of the bottom is 27 feet from foundation-wall and lies there flattened and destroyed by the fall. The lower 40 feet of the cylinder was completely demolished and thrown in every direction in not less than sixteen principal pieces, which cut down trees and ploughed great furrows in the earth. Segments of the lower courses of plates struck the bottom of the tank and tore several gashes through the steel plates. The inundation was severest to the south-west, sweeping away much of the mortar-laid foundation of a frame house 350 feet away, and extinguishing fires three

of water in the tank, and the pumps were in motion putting in more water at the rate of about 400 gallons per minute, the water-gauge at the pump showing from 100 to 105 pounds per square inch. The pump had been running at this rate since six o'clock, Wednesday, P. M., and the gauge had been steadily rising, as it should, with no apparent shocks. At 2:10 Thursday morning the engineer, who was watching the gauge, saw it suddenly drop to 60, and the pump start off at a terrific speed. He shut off steam and notified the superintendent.

An inspection of the ground at the hill showed the main body of the tank torn, and lying unrolled across the field-stone underpinning (Fig. 1). The bottom is in five pieces, one lying on the west slope of the hill, about 200 feet from the foundation; the other four were on the eastern slope, and 50 and 75 feet away. The largest piece of the five—about one-half of the bottom—

was lying *upside down* about 150 feet east from the foundation, and was so covered with bricks and timber that it could not be thoroughly examined. The bricks and timber were carried in every direction down the hill, but no damage of any consequence was caused outside of the structure itself. The brick walls were completely demolished, a few patches of the first course being all that can be seen of the bricklayers' work.

The tank stood on a hill where an outcrop of rock afforded a perfect foundation, and the underpinning,



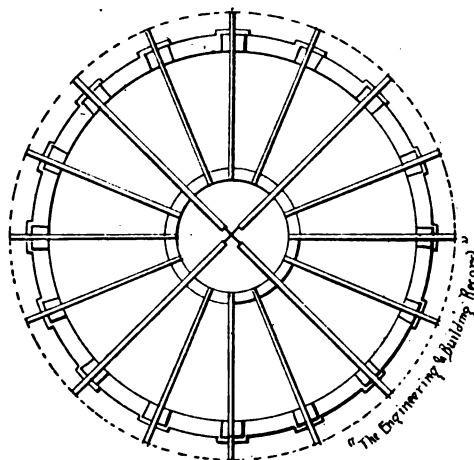
which was of field stone laid in cement mortar, was in no way affected by the accident.

The raising was done by Isaac Blair, of Boston, by contract, and the brick-work by Charles H. Corbin, of Franklin, by day labor. Before beginning the work of raising, the tank was emptied and the town supplied by direct

During the lifting the centre of the tank bottom "buckled" up an inch. The brick-work was carried along as the tank rose and when the walls were brought up to a bearing on the I-beams the bottom brick-work was four weeks old. The mortar was of cement, lime, and sand; in just what proportions could not be learned. After the accident at least one-half of the 180,000 bricks that were scattered about had little or no mortar on them, while to the others the mortar was reasonably adherent.

The upper courses of brick had been finished only a few days when the tank was allowed to partially rest upon them.

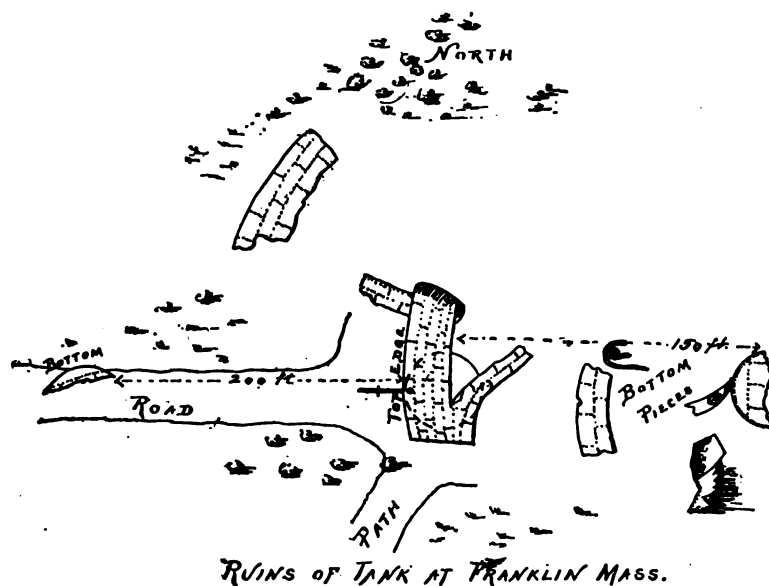
The tank was single riveted throughout. Some of the sheets forming the bottom near the circumference were $\frac{3}{8}$ of an inch thick, but most of them would measure only $\frac{1}{8}$ of an inch. The barrel was seven sheets high—35 feet



—the lower four being $\frac{1}{8}$ of an inch and the upper three $\frac{1}{4}$ of an inch thick. Midway around the inside of the tank was a ring of 3-inch T-iron, and the top edge was stiffened by a 2-inch angle-iron.

The bottom was joined to the barrel by 4-inch angle-iron, and a broken piece showed a thickness of $\frac{1}{2}$ -inch at the angle. In all of the bottom that could be examined the barrel sheets had been wrenched outwardly from the angle-iron.

At some places the barrel sheet was completely torn away; in others the tear was through the rivet holes, at others just above the angle-iron, and in others the angle-iron itself was broken.



pumping. Holes were cut in the underpinning to allow 18 jacks to be placed about the circumference, and by suitable blocking the tank was raised five feet from its original position. A flooring of hard pine planks $5\frac{1}{2}$ inches thick was then put under the bottom and supported by 16 9x4 I-beams, placed radially, and four of them tied diametrically, as shown in plan. These I-beams were kept apart by hard pine braces, and were supported by timbers so placed as to form a hexagon just inside the outer brick wall, and these in turn rested on 23 jacks and the blocking. From the 5-foot to the 25-foot level above the underpinning, seven men worked the jacks, but at that level three men were taken off, and four carried the tank to its 45-foot level.

Water was supplied to and drawn from the tank by a single pipe of 12-inch cast iron, which entered the structure on the west side, and was rigidly bolted to the bottom of the tank about six feet from the circumference. This pipe was broken off about two feet below the top of the underpinning at the bell of the bottom elbow, and the lower end was thrown out to the west with sufficient force to cause the top end to fall not more than ten feet east of the bottom elbow, and at the time of the accident the door of the new brick tower was closed.

[We take pleasure in saying that the superintendent, Mr. W. E. Nason, was exceedingly courteous and rendered our representative every aid in his power in the work of collecting the foregoing facts.]

THE CAPE COD SHIP CANAL.

THE Cape Cod Canal has been before the public for many years, and several companies have held charters for it, but have given up either for want of funds, bad management, or some other cause without leaving any traces on the ground.

A company, incorporated in 1870, came to trouble by a series of underlettings. About 1880 the job of digging the canal was started by sub-contractors with Italian laborers, but there was some difficulty about the pay, and this ended in a riot, which the militia was called upon to quell.

The present company succeeded to the rights and titles of its predecessors after paying all the damages caused by the riot and the labor bills. It has spent several years in building a dredge and making surveys. The dredge has been in operation some six months or more, having been considerably altered over, as it was found to be at first too light for its work.

When all was in working order it was found that the charter was so near expiring that capital could not be obtained to carry out the work. The Massachusetts Legislature has, however, just renewed the charter to the present company, and it is expected that the waterway will be opened within three years.

The site selected for the canal is a narrow valley (see Fig. 72) running across the peninsula from Barnstable Bay on the north to Buzzard's Bay on the south. At each end there is a small stream running through the valley, and for most of the distance the marsh is about three feet above high tide. The canal is to be 200 feet wide at water-line and 28 feet deep, being 75 feet wide on the bottom, with turn-out stations 150 feet on bottom. The bottom is to be 22 feet below mean low tide and 32 feet below high tide.

The line of the canal will present three curves of some 7,000 feet radius. It will be $7\frac{1}{2}$ miles from shore to shore, or about nine miles including the channel in Buzzard's Bay out to Wing Neck Lighthouse. The natural conditions are such that there is only one short section of cutting much above tide marsh. This cut is 39 feet above the tide for a short distance; most of the cutting will be from two to three feet above tide level.

At present the line of the Old Colony Railroad crosses the canal line at three points on the main Cape line and once on the Wood's Holl branch.

The Canal Company propose to rebuild a part of the railroad so as to have but one crossing, as shown in dotted line on plan, and have obtained the consent of the railroad company to the change. This will necessitate one draw-bridge and for public way some system of ferries will probably be established, with possibly one or two bridges. It will be necessary to build dykes at the Barnstable Bay end to keep the entrance clear, owing to the currents which follow the shore and are constantly changing the outlets to the different streams entering the bay. The United States Government has had under consideration a project for building a harbor of refuge somewhere on this coast, and the large tracts of low marshes near the line of canal present a very favorable location for it here.

The difference in tides of the two bays is about five feet of height and $3\frac{1}{2}$ hours difference in time, and it is estimated that the maximum current due to tide will not be over four miles per hour.

Mr. F. A. Lockwood is the builder and contractor for the dredge described above. Charles M. Thompson is the engineer having charge of all the work of surveys, soundings, etc. He has made a large series of tests by pits and wells, and finds that the material is marsh muck, sand, and clay. Some few boulders will probably be met, but no rock or ledge has been found or is likely to exist.

Total amount of excavation estimated, 11,500,000 cubic yards. At the present time the dredge has excavated some 1,200 feet of channel the full width and from 12 to 18 feet deep.

The officers and directors of the Cape Cod Canal Company are: President, Hon. W. A. Clark, Jr.; Treasurer, Samuel Fessenden; Directors, Edwin Reed, William A. French, Sidney Dillon, Gen. Charles C. Dodge, Thomas Rutter; Engineer in Charge, Charles M. Thompson; Contractors, F. A. Lockwood, Boston; Smith & Ripley New York.

BUILDERS' AND CONTRACTORS' ENGINEERING AND PLANT.

No. XXIV.

(Continued from page 582.)

THE LOCKWOOD DREDGE—CAPE COD SHIP CANAL.

Most of the harbors of this country are of natural formation, requiring comparatively small amounts of dredging, and this mostly for the purpose of removing bars, deposits brought down by rivers or sewers, and keeping the channels clear. This kind of work has brought out a quantity of different styles of dredges of the clam-shell and scoop type, having an intermittent compound motion by which a scoop or grab is lowered into the material to be removed—pressed into it—then raised and emptied into scows; simulating to a certain extent manual labor.

In Europe most of the large harbors are formed artificially, necessitating large amounts of dredging and excavating, and for this purpose continuous or bucket-dredges have been of almost universal use; but they are of comparatively recent introduction in this country.

The dredge now at work on the Cape Cod Ship Canal, at Sandwich, Mass., though an outgrowth of the Hercules type, differs from it in many essential parts. Being the first of its kind built, it naturally has been considerably altered in details from its first design. We present two general views, Figs. 73, 74.

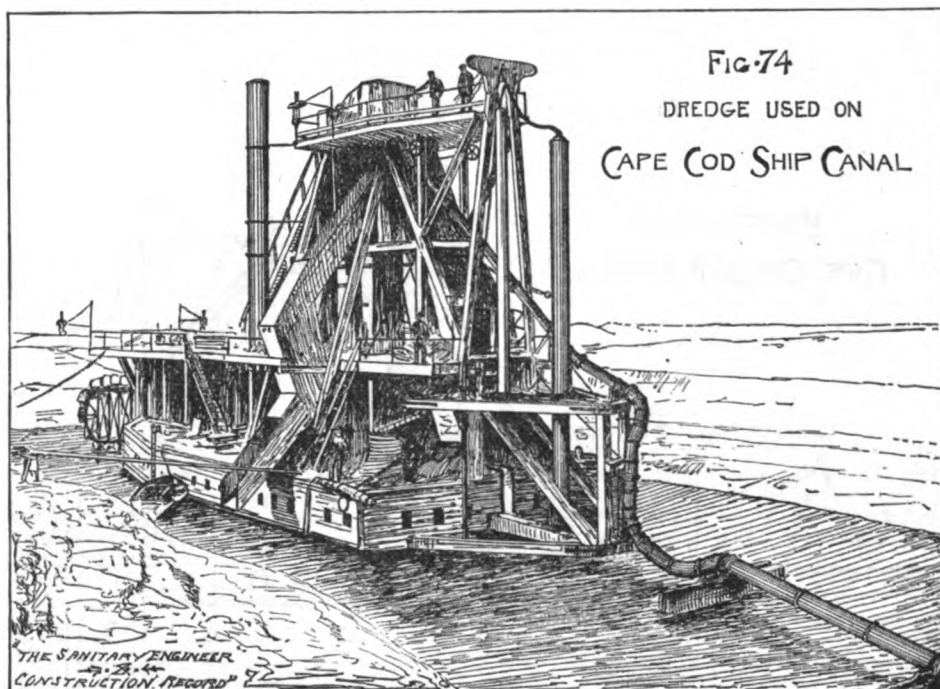
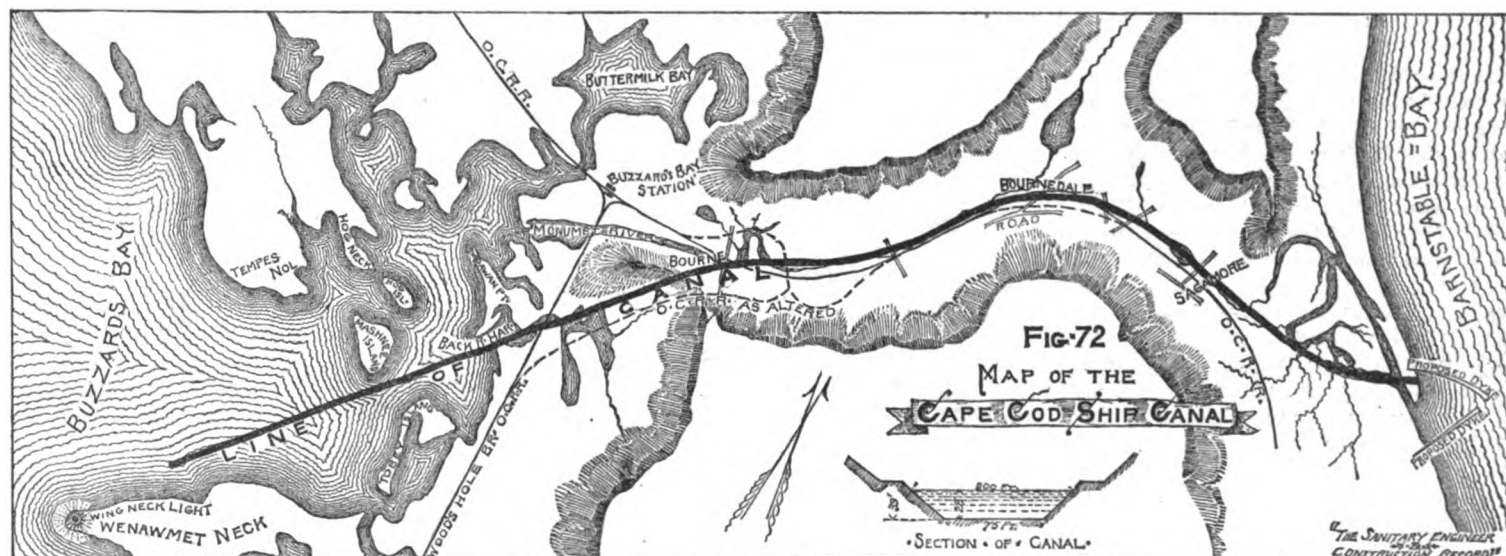
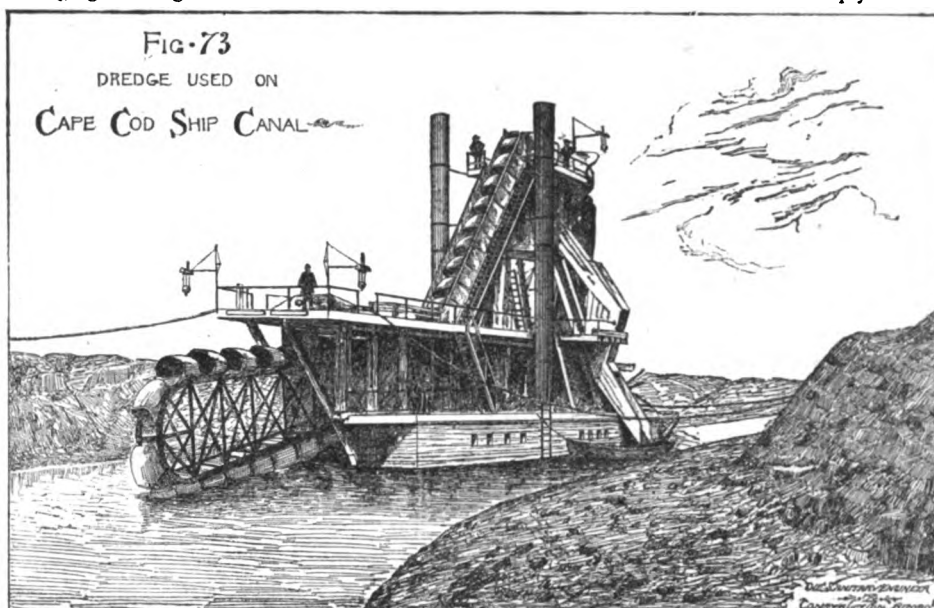
It was designed and built by F. A. Lockwood, of East Boston, under the patents of J. A. Ball, of Oakland, Cal.

In a general way it consists of a large flat-bottomed barge, decked over and containing all the boilers, engines,

it is carried to the shore by a system of pipes and water-carriage.

First—The first distinctive feature of the Lockwood dredge is the fact that the chain and buckets revolve so as to attack the material from the top on the *downward* motion, thus bringing the weight of the buckets and the laws

Second—Most other dredges and excavators have their chain revolving on a drum at top and bottom of a bucket-ladder, with intermediate rollers to support the chain. In the Lockwood dredge the chains are formed with a series of castors which run on a track like a train of cars, and the lower end of the bucket-ladder is simply a curved track in



and pumps for working the dredge. Fig. 75 is a general plan of lower deck of the barge. Fig. 76, a plan showing framing. Fig. 77, a general view looking down. Fig. 78, a sectional elevation. From the barge rises a tower with a raised platform, supporting an endless chain with buckets which, as it revolves, continuously scoop up the material and deliver it to the top of the tower, from which

of gravity to the help of the motive power, and carrying the load under water as far as possible, thus reducing its weight. The Hercules and the European dredges work in the opposite direction, cutting the material on the upward motion. The large European excavators used on land, many of which are at Panama, work, however, on this principle of the down stroke.

a vertical plane. The details are shown in Fig. 79.

Third—The bucket-ladder is in two sections, Fig. 78. That part above water is stationary, and only the part in the water is movable, and can be raised or lowered according to the depth of excavation necessary. Two positions of the ladder are shown.

Fourth—The material brought up to the top of tower may be delivered into scows by means of wooden shoots on either side, but is usually delivered into a hopper, where a strong stream of water breaks up the cakes and carries the stuff off through a pipe, which extends to the shore. No churn or cutter is used, the stream of water being sufficient to break up the material.

Fifth—One other novelty is the mode of propulsion of the dredge. At the extreme rear end of dredge is a projecting frame, on which are adjusted cast-iron sliding-collars. Through these collars is passed a large wooden spud, 18 inches in diameter and 80 feet long, shod with an iron shoe some 7 feet long. This being dropped into the bed of the canal, forms a centre post on which the whole apparatus can revolve, and by means of rack and pinion gearing the dredge can be pushed away from this spud (or drawn to it). When the collar has reached the end of the frame-work there is a second spud, just at the back of the dredge, which is dropped so as to hold the dredge in place, while the other spud is raised by means of a large pair of shears, then the collars are drawn in by means of the rack and pinions, and the spud is again dropped and the other one raised.

The Lockwood dredge, No. 1, is 80 feet long by 36 feet beam, and has a draft of some six feet. The working-deck overhangs the front of the barge some 20 feet, and there is a vertical slot cut in the same for the passage of the bucket-ladder.

The tower is some 60 feet above the bottom of the hull and is supported on six 12x12-inch wooden posts, with 12x12-inch braces from either side and ends.

The stationary track for buckets extends from top of tower to within 6 feet of the deck, and is formed of 8x8 and 12x12-inch joists and stringers. The movable portion, or bucket-ladder, is of iron; it is formed of two trusses, the top and bottom chords of which are converging, and are made of a 5x5x $\frac{1}{2}$ -inch angle-iron bent at the lower end on a circle of 10 feet diameter. At the upper end the lower chord is bent up on a $\frac{1}{4}$ -circle of 4 feet radius, and connected to top by a diagonal. The pivot on which the ladder hangs is located here. The panels of the truss are formed of 5x2-inch channel uprights and 3x2-inch angle-iron diagonals, and the two trusses are united by 3 $\frac{1}{2}$ x3 $\frac{1}{2}$ T-irons. That part of the ladder which passes through the opening in barge is made wider by extending the T-irons, and placing 5x2-inch channels outside of the angle-irons so as to steady it and keep the buckets clear of the sides of barge. The ladder has nine panels 6 feet on centres and is 63 feet over all, or 60 feet from pivot to point. The weight of the outer end of ladder is carried by chains, which pass over pulleys on the upper deck and connected by iron rods to an 8x8-inch timber on either side, which is 34 feet long. This timber has a rack on its underside which engages a pinion by which power is applied to raise or lower the ladder. Just above the location of the pinion is an iron roller which bears down on top of the 8x8-inch timber and keeps it in place. The rail on which the chain runs (the 5x5-inch angle-iron) has a bearing or wearing surface formed of plates of half-inch steel bolted on in short sections so as to be easily renewed.

The buckets, of which there are 30, Fig. 79, are of wrought iron, riveted to 3 $\frac{1}{2}$ x3 $\frac{1}{2}$ x $\frac{1}{2}$ -inch angle-irons and have a cutting edge of 6x $\frac{1}{2}$ -inch steel. They have a capacity of about 18 cubic feet. The bottom is separate and hinged to the chain, so that, as the bucket turns over the top drum, the material slides off of the bottom. There is an iron apron in front of each bucket to prevent material from dropping off as the bucket cuts into the bank. The chains, of which there are two each 234 feet long, are formed of plates of 4x1-inch iron in pairs alternately 16 and 11 inches long, riveted together by 1 $\frac{1}{2}$ -inch steel pins 5 $\frac{1}{4}$ inches long. Each set of 16-inch plates carry a 7-inch iron roller, or castor, on a 1 $\frac{1}{4}$ -inch pin. The two chains are connected by the roller-pins, which also pass through the different projections of the buckets, as shown in detail plans.

The power is applied to the chains by means of a pair of drums, or sprocket wheels, at the top of the tower. These are driven by bevel gears 30 and 20 inches on an 8-inch shaft 46 feet long, extending down to the engine-room.

The motive power is all located in the barge below deck. It consists of four boilers of the locomotive type set in pairs on either side, with coal-bunkers in the front end. They consume about one ton of coal each per ten hours.

The steam is supplied to two 75-horse-power reversible engines located amidships; cylinders, 12 inches, 24-inch stroke; speed, 75 revolutions in ordinary working. They are both connected to a single fly-wheel. Power is distributed from these engines by means of bevel gears to the different parts as required. The engines are connected to a 6-foot spur wheel, from which motion is transmitted by the 8-inch vertical shaft to the drums at top of tower. These gears are furnished with large friction cones and cast-iron friction boxes, so as to be slowed up as may be required. A counter-shaft carries power to the two sets of pinions, which by means of racks gives the sliding motion to the collar on the spud at rear of dredge. Another gear connects to the rack which raises and lowers the bucket-ladder. Still another carries the power forward to a pair of grooved capstans by means of which the front of dredge is made to revolve on the spud centre. A similar capstan is used in connection with the shears by which the spuds are raised.

The boilers furnish steam to three Blake pumps. These have a 10-inch suction and deliver 12 gallons of water per stroke at the rate of 60 strokes a minute. The supply of one of these pumps passes through the condenser, after which it joins the other supply and is delivered by a conical nozzle into the hopper at the top of tower. The force of the stream is sufficient to break up all the cakes of muck and clay so that it can be carried off by the water through an 18-inch iron pipe. There is also a small engine to furnish power to a dynamo for electric-light; this is to be used for night work and after dark in winter.

On the upper deck, twelve feet above the main deck, is located near the front the capstan mentioned above. This is formed of two grooved rollers over which a rope is passed four times and the ends made fast to shore. The speed of this is regulated so that each bucket strikes the shore just eight inches (laterally) beyond its predecessor. That is, each bucket takes a slice, two feet inshore and eight inches wide, the rope being drawn in on one side and let out on the other. By these means the dredge can swing around and dredge a channel of 125 feet. Just ahead of this capstan are the two pulleys over which the ladder chain passes. A painted scale on the deck shows the depth at which the

buckets are working. These chains allow the ladder to be lowered to a depth of forty feet.

The ladder is first set to dredge ten or fifteen feet deep, and when it has advanced as far as required it can work back and deepen the channel by lowering the ladder; or a second or third dredge may be started behind it, each cutting somewhat deeper. At the rear is the frame-work on which the spud collars slide in and out; also the capstan by which the spuds are raised. The lifting shears, which are twenty-five feet high, are held at the top by means of two iron braces bolted together at bottom and held in an iron frame made fast to the floor. This frame has a series

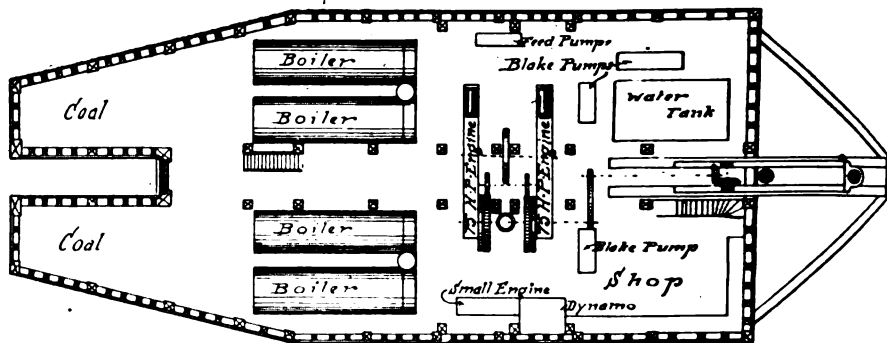


FIG. 75 PLAN SHOWING LOCATION OF ENGINES &c.

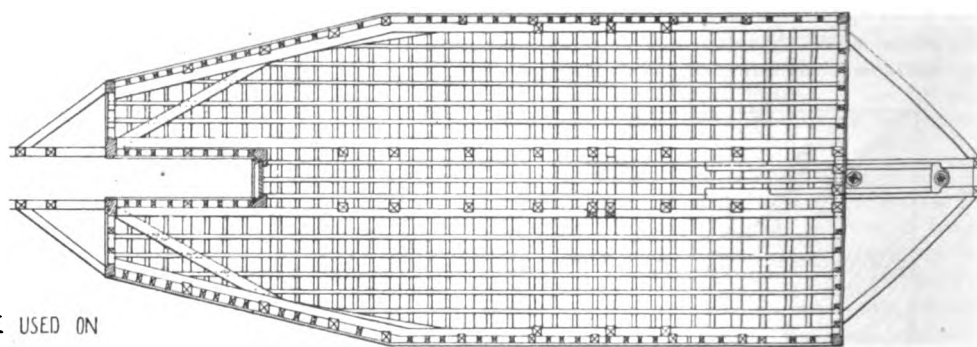


FIG. 76 FRAMING PLAN

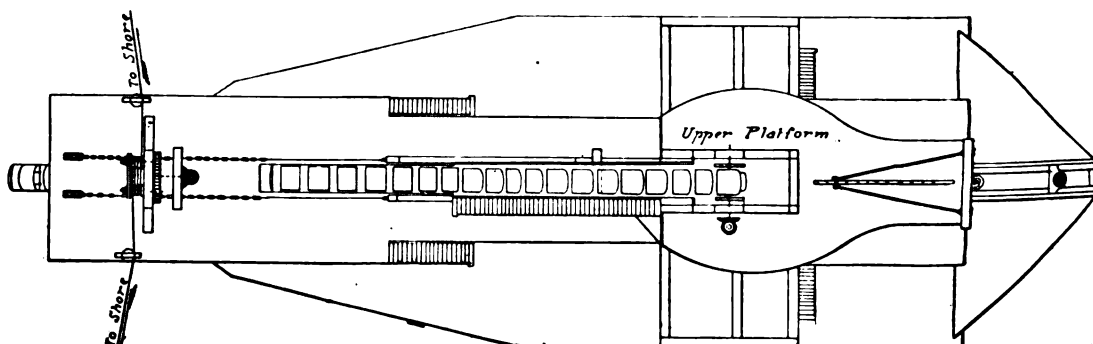


FIG. 77 GENERAL VIEW OF DECKS

DREDGE USED ON
CAPE COD SHIP CANAL

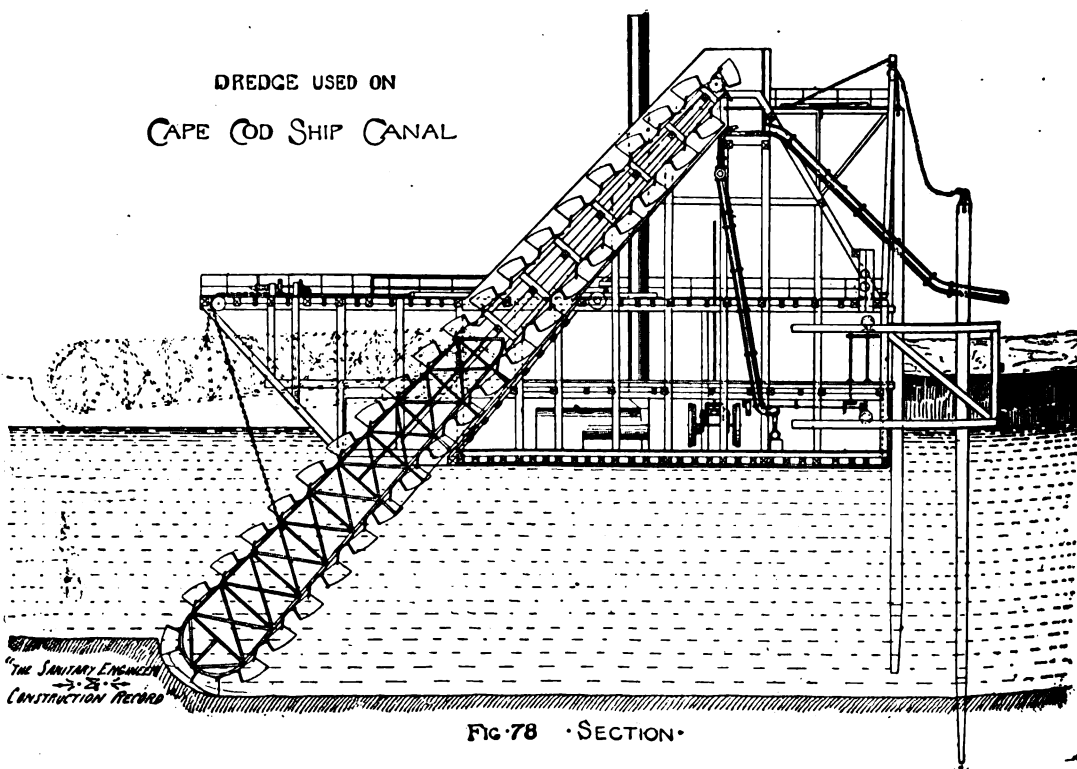


FIG. 78 SECTION

of hooks on which the bolt is caught so as to give the required inclination to the shears.

In ordinary work the buckets revolve at the rate of 14 buckets per minute and will deliver easily 4,000 yards per 10 hours.

The delivery pipe is eighteen inches diameter wrought-iron, with cast-iron flange joints and spherical unions. Each straight section beyond the dredge is placed on a float and the end carried over the top of the bank where the material is delivered, and the water flows away to some natural or artificial outlet. At Sandwich it is necessary through the marshes to prepare a small bank each side of

requisites of stability and strength; stability being the power of resisting forces tending to overthrow the structure, or to derange the parts of which it is made, from their proper relative functions; and strength, "the power of resisting forces tending to alter the figures of those parts or to break them in pieces."

It is evident, therefore, that the engineer to be proficient in his calling must inform himself on the special properties of the materials employed in constructions, whether earth, stone, brick, timber, iron, or other substance, as well as on the kind of treatment or workmanship to which such material may be subjected, and the form in which it can be most advantageously used. He must learn by practical experience of the action of materials under service and in all accidental conditions to which they may

the laws of river and ocean currents, the formation of sand-bars, etc.; the mining engineer requires knowledge of sinking shafts, of tunneling, must be familiar with geology, mineralogy, and chemistry; the mechanical engineer must be able to consider all questions of machines, motive power, etc.; the electrical engineer manages all matters in the application of electricity to the uses of man; the bridge engineer constructs bridges; and the building engineer, or, may we not say, the architectural engineer, takes up all questions in relation to the construction and strength of buildings.

Architecture, strictly speaking, is a fine art; as Fergusson expressed it, the "Queen of the Technic Arts;" "the art of ornamental and ornamented construction." While architecture has its "roots in pure utility," it is a question whether when the first shelters were constructed it was not engineering ability that accomplished it, architecture only developing when man began to ornament and to decorate his constructions in order to gratify his inborn "craving for beauty and love of proportion."

The pure architect begins where the engineer ends. Without the engineer the architect would give strength to his constructions merely by satisfying his eye and sense of proportion, leaving the rest to chance. So soon as he begins to work up the size of the parts for the loads they have to sustain, or to consider the strength of materials and the forces to be resisted, then he becomes an architectural engineer.

One may by study and experience become an expert on the subject of architectural engineering, yet never make an architect, lacking talent and artistic taste; but the field of the pure architect is a very limited one. All engineers cannot be architects, but all professing architects must be engineers, more or less, and the more ability one possesses in this line, the more chance for his success in the great constructions of the day. To quote Fergusson again: "It is not essential that the engineer should know anything of architecture, though it is certainly desirable he should do so; but on the other hand, it is indispensably necessary that the architect should understand construction." "Without that knowledge he cannot design." If he feels inability in this direction he should associate with one who can supply the deficiency and reserve to himself the artistic department of the profession. It is very seldom that perfect artistic and perfect mechanical ability can be found in a single person, though if one who is an engineer by education feels that he has this artistic skill, there is no reason why he may not make one of the best of architects.

It may be seen, therefore, that no strict line of demarcation can be drawn between engineering and architectural practice; that one merges into and becomes an essential part of the other, architecture being all the more beautiful and satisfying, as well as practically correct, when its lines correspond with the lines of engineering construction. "The one is the prose, the other the poetry of the art of building."

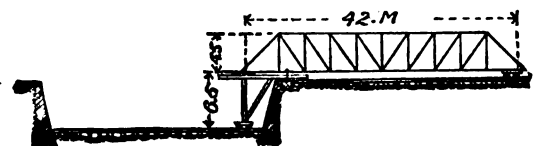
A NOVELTY IN BRIDGE ERECTION.

WE take from the *Wochenschrift des Oesterr. Ingenieur und Architekten Vereines* the following, contributed by Engineer A. Budau:

The machine works of Stabilimento forlivese (Italy) recently received the contract to build an iron road bridge, in one span, over the Montone River at a place called Passo del Braldo, about six kilometres from the city of Forli.

Material for temporary trusses not being obtainable, it was decided by the engineer, E. Forlanini, to build the bridge all on one bank, and then to push it across to the other side. It should here be mentioned that the Montone River is nearly dry in summer, but a flood of rushing waters in winter.

When the bridge was quite finished it was placed on two small cars, one under the river end of the bridge and the other under the shore end, as seen in the following sketch.



Long stringers supporting channel-iron rails were then placed on the bank and on the bed of the river for the car-wheels to run on. When all was ready, and the bridge ends fastened to the cars, the river car being surmounted by a scaffolding, the shoving or pushing of the bridge began. Two workmen armed with crowbars were at each car wheel, and they kept prying the structure across, no other power being used. The time taken for the work was seven hours. The bridge as shoved across weighed 59 tons.

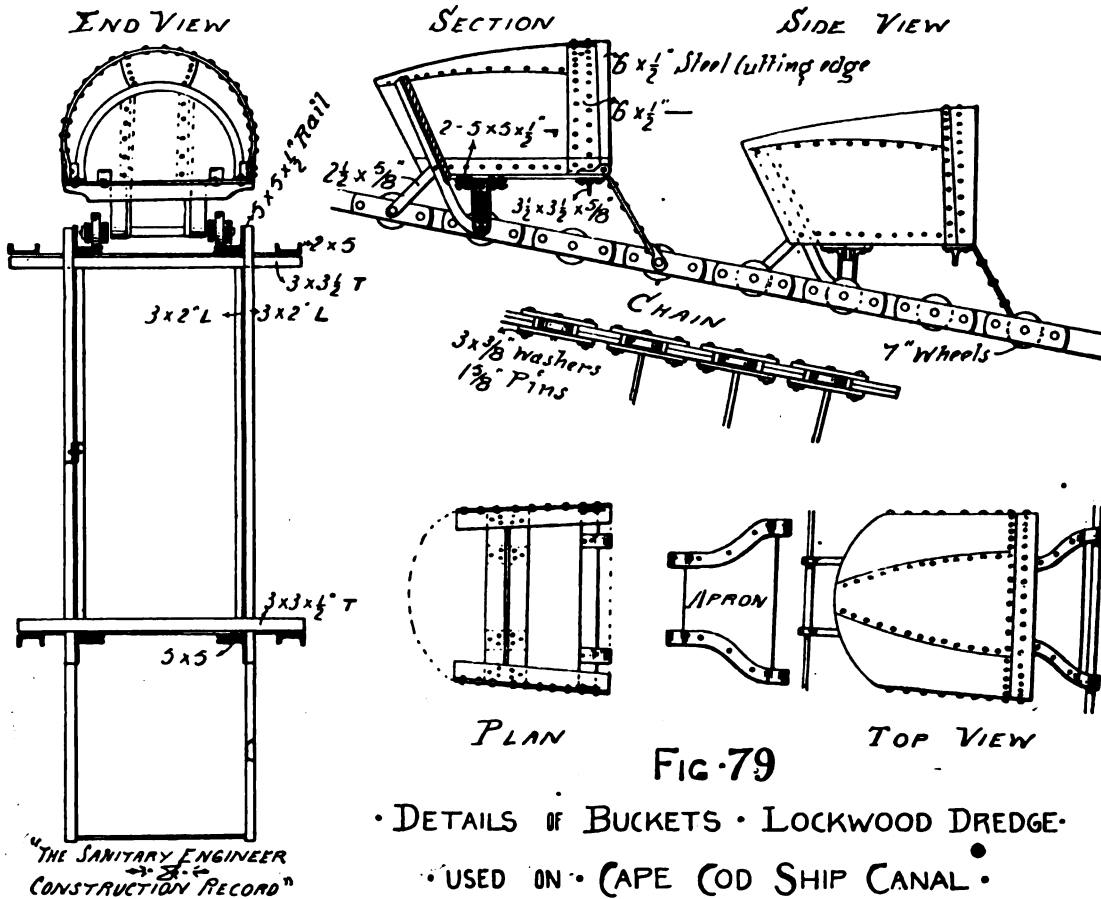


FIG. 79

DETAILS OF BUCKETS - LOCKWOOD DREDGE.
USED ON CAPE COD SHIP CANAL.

the canal some three or four feet high over which the pipes are discharged. On the dredge the delivery pipe has a circuitous route, as it is necessary to pass around the spuds and yet leave the dredge on the centre line to allow of the swinging motion of dredge.

This dredge cost some \$125,000, of which about \$40,000 was spent in alterations and improvements. It is estimated that it can be duplicated from \$90,000 to \$100,000.

A force of twelve men is necessary to work the dredge, including engineers and firemen, and it is said to excavate at the cost of less than three cents per cubic yard.

(TO BE CONTINUED.)

WHERE THE LINE OF DEMARKATION BETWEEN ENGINEERING AND ARCHITECTURAL PRACTICE IS TO BE FOUND.

ABSTRACT of paper by Joseph M. Wilson, A. M., C. E., F. A. I. A., Mem. Am. Soc. C. E., Mem. Inst. C. E., London, Eng., read at twenty-first annual convention of American Institute of Architects, held in Chicago:

Engineering covers a broad field, said he. One eminent as a professor and writer on this subject, has said that "Engineering is the art and science by which the mechanical properties of matter are made to serve the ends of man," or, in other words, it is "the useful application of mechanical science to those ends." In the widest sense, almost every one is more or less a practical engineer—the man who makes a passage across a torrent by means of a fallen tree, as well as the man who constructs the most complicated piece of machinery, or rears a lighthouse on the most exposed rock of the ocean. Little or nothing can be constructed or built without encroaching on the province of the engineer.

The objects treated by the science of engineering may be classified under two heads, structures and machines, the latter being those "combinations of solid materials, whose parts are intended to have relative motion and to perform work." A machine may be a structure, but structures are not necessarily machines. In the words of the same writer, "The theory of structures, which is founded on the principles of statics, or the science of equilibrium, is divided into two parts, relating, respectively, to the two

be exposed, and by this experience he should be enabled to allow for all such conditions and for variations which may occur in the recognized properties belonging to these materials.

Engineering is an exact science and its application to any construction involves the principles by which the structure may be built, in the whole and in each part, according to the best design for accomplishing the uses to which it is to be adapted and for resisting the forces that must be sustained by it. The more nearly these conditions are fulfilled, the more efficient, durable, and economical the structure will be, and also to the educated or artistic eye the more beautiful, as the lines and proportions will be the best and truest to satisfy the purposes of the structure.

Engineering may be divided into two grand departments, civil and military. With the latter we need not now be concerned. Civil engineering, in its most general significance, may be said to involve those applications of mechanics and the arts of construction which treat of the formation and building of lines of transport for freight and passengers, whether by water, highway, or railroad; the construction of works for water-supply and drainage; the theory and practice of mining, and the formation of harbors and works for protection of the coast and for aid to navigation. All of these works comprise "combinations of structures and machines;" "structures in earth-works, as cuttings, embankments, and reservoirs; in masonry, timber and iron, as bridges, viaducts, aqueducts, tunnels, locks, basins, piers, and breakwaters; machines, such as carriages, locomotive and stationary engines, lock-gates, sluices, valves, pumping-engines, and dredging-machines." And in the "old days" the civil engineer was expected to be able to undertake all of these objects. In modern times, however, business has so much increased in each department that engineers can afford to devote themselves to particular subjects, and civil engineering is rapidly dividing into specialties.

One of these may be considered as involving "the laying out and constructing of lines of transport, and selecting the sites for works in the best manner possible with reference to the features of the country, so as to secure economy in execution and working."

Hydraulic engineering takes up the question of water-supply, and requires study of the laws of rainfall, the supply and flow of streams. Sanitary engineering comprises matters of drainage and ventilation; the engineer of coast works must understand the action of waves.

THE ENGINEERS' CLUB OF PHILADELPHIA.

A REGULAR meeting of the club was held October 15, 1887, Past President Frederic Graff in the chair; Mr. Howard Murphy, Secretary; 20 members and one visitor present.

Mr. A. Marichal presented a description of the Gileppe Dam, Belgium, illustrated by photograph and drawings, and followed by a discussion having for its object to prove that a saving of 50 per cent. of masonry could have been effected, together with an increase of stability, by adopting a profile taken from his "Diagram for the Construction of Reservoir Walls," presented to the club on May 21, 1887.

The Gileppe Dam was completed in 1879. The object of its construction was to supply the city of Verviers with water. The capacity is 3,173 million gallons. The dam is 49.2 feet wide at the top and 216 feet at the bottom; its total height is 156.6 feet. At the top the dam is 771 feet long and at the bottom 269 feet. It is built of rubble masonry, weighing $1\frac{3}{4}$ tons per cubic yard.

The dam is surmounted by an immense statue of a lion. This statue is composed of 183 pieces of sandstone. Its total height is 70.52 feet; the body is 16.4 feet wide and 52.5 feet long. One of the claws measures 5.31 feet and the length of the nose is 8.20 feet.

In concluding, Mr. Marichal made a graphical and analytical comparison between the profiles given by his above-mentioned diagram and those of some dams already in existence and designed by the most competent engineers.

Mr. A. Saunders Morris presented notes upon "Connections for Secondary Batteries."

Arrangements for connecting the elements of storage batteries have given some trouble, principally on account of oxidation. The best form of connection is one in which the joint is removed as far as possible from the acid, and which can be readily detached for the purpose of removing the element.

Several forms of binding posts or connections were exhibited, made of tough lead alloy. Both male and female threads are cast so that the castings are turned out of the molds, completely finished, at the rate of one per minute. The mold for casting the screws was also exhibited.

The Secretary presented, for Mr. W. H. Nauman, a description of tests for riveted joints, made at Watertown Arsenal, Massachusetts, for the Bureau of Steam Engineering, September, 1886, accompanied by very complete drawings and tables.

Mr. Henry Roeske, of Philadelphia, introduced by the Secretary, presented an illustrated description of a system of water filtration devised by him. He preceded this description by a historical sketch of the filtration of water and the various principal devices which have been used for the purpose of accomplishing it. Mr. Roeske's filter consists of a series of compartments so arranged that a large excess of water can be used for agitating and cleansing the filtering material in each compartment separately, while the rest of the compartments are furnishing a continuous supply of filtered water. The material in each compartment is designed to be cleansed at intervals of hours or days, as may be desired, by the action of automatic valves, which are operated by a lever formed of pipe, which fills with water at the designed intervals, and by its thus increased weight operates the valve. Sand and coke are the materials used. They are placed in separate compartments, the design being to protect the coke from the coarser impurities, so as to lengthen the time of its use. It is intended that the coke be used also as fuel after removal from the filter.

THE WESTERN ASSOCIATION OF ARCHITECTS.

THE next convention of the Western Association of Architects will be held in Cincinnati on Wednesday, November 16. A special rate of \$11.80 for railroad fare from Chicago to Cincinnati and return has been obtained. In order to secure this rate, it was necessary to guarantee that fifteen or more persons would go on one date and *via* the same line. The Monon route, L., N. A. & C. Ry., has been selected as the line to be used by the members and their friends from Chicago and the North-west. Special accommodations will be provided for ladies, and it is hoped that the delegates and their friends will bring the lady members of their families. J. F. Alexander, Lafayette, Ind., is the Secretary of the association.

THE WESTERN NEW YORK ASSOCIATION OF ARCHITECTS ORGANIZED.

A WELL-ATTENDED meeting of the architects of Rochester and vicinity was held in that city on October 29.

Among those present was a lady architect from Buffalo, Miss Louisa Bethune. Others were: Louis P. Rogers, James G. Cutler, John R. Church, Charles F. Crandall, W. H. Richardson, Orlando K. Foot, Jay Fay, W. C. Welder, W. Foster Kelly, O. W. Dryer, Otto Black, Thomas Nolan, Rochester; J. Q. Ingham, J. H. Pierce, Elmira; E. A. Curtis, Fredonia; E. M. Buell, George W. Baxter, Ellis G. Hall, C. E. Colton, J. H. Kirby, Asa L. Merrick, Syracuse; C. R. Percival, Cyrus K. Porter, W. W. Corlin, R. A. Bethune, Buffalo.

Louis P. Rogers, of Rochester was made temporary chairman, and R. C. McLean, of the *Inland Architect*, Chicago, temporary secretary.

After a report from the committee on by-laws had been received and approved, an organization to be known as the Western New York Association of Architects was perfected, with the following list of officers:

President, James G. Cutler, Rochester; Vice-President, Cyrus K. Porter, Buffalo; Second Vice-President, E. A. Curtis, Fredonia; Secretary, W. W. Carlin, Buffalo; Treasurer, C. E. Colton, Syracuse; Executive Committee, J. H. Pierce, Elmira; Louis P. Rogers, Rochester.

THOMAS U. WALTER.

THOMAS USTIC WALTER, designer of the extension of the United States Capitol, of the Girard College Buildings at Philadelphia, and other notable works, and for many years President of the American Institute of Architects, died in Philadelphia October 30, in the 84th year of his age.

Mr. Walter was born in Philadelphia September 4, 1804, where he received a fair education. When fifteen years of age he began his study of architecture, entering the office of William Strickland, who was the designer of the Custom House and the Mint in Philadelphia. He did not, however, complete his studies and engage in practice until 1830. The next year his design of the new County Prison was accepted, and but two years afterward he prepared the original designs for the Girard College building and was given charge of the construction. Previous, however, to commencing work on the building he was sent to Europe by the Building Commission, where he studied the architecture of Europe. On his return work at the college begun, and was finished in 1847, his plans having been followed throughout.

This work gained him a reputation, and he was employed by the Venezuelan Government to prepare plans for the construction of a breakwater at Laguayra, which he did. In 1851 he prepared plans, in competition with other architects, for the extension of the National Capitol buildings, which were accepted, and Mr. Walter was retained to superintend architectural construction, with General M. C. Meigs, U. S. A., as engineer. He removed from Philadelphia to the Capital, where he lived for fourteen years. While there he designed the extensions to the Treasury, Patent Office, and Post-Office buildings, and the great dome on the old Capitol, the Congressional Library, and the Government Hospital for the Insane.

In 1865 he returned to Philadelphia to live, and designed his own residence in Germantown, intending to retire from active practice. But financial misfortunes overtook him, and he was compelled to re-enter professional life, accepting the position of assistant in the architect's office of the Pennsylvania Railroad Company, where he remained until the commencing of operations on the public buildings of Philadelphia, when he became Mr. John McArthur's assistant, and so continued until his death.

There are many notable buildings in Philadelphia which he designed, among them being St. George's Hall, Preston Retreat. He always made a specialty of the classic antique style, and nearly all the buildings designed by him are of that style.

Mr. Walter was one of the original members and President, until the last meeting in Chicago, of the American Institute of Architects, at which time he was relieved of the duties at his own request, and the institute bestowed on him the office of honorary president.

He has been a member of the Franklin Institute of Philadelphia for nearly 60 years, and at one time was Professor of Architecture in it, and since 1841 has been a member of the American Philosophical Society. Besides

these he has been an interested member in a number of literary and scientific societies. In 1851 the University of Lewisburg conferred the degree of Doctor of Philosophy on him and Harvard College conferred on him the degree of LL.D.

Mr. Walter leaves a wife, two sons, and three daughters. The immediate cause of his death was a severe cold acting on the debility of old age.

ACCORDING to the *Deutsche Bauzeitung*, the "Krembsen Circus Building," in Berlin, which is built entirely of iron, was equipped complete in twelve days, with a hot-water heating apparatus. The pipes are so arranged as to run under each seat.

THE *Revue Industrielle* gives an interesting account of some recent experiments in England with the regular army powder and the Johnson-Barland smokeless powder. In one test a Martini-Henry rifle was used. The charge of ordinary powder used was 5.5 grammes, which gave the bullet an initial velocity of 400 metres. With the Johnson-Barland powder the charge was 3.9 grammes, which gave a velocity of 463 metres. A second test, made with two Martini-Enfield rifled cannon, showed that the regular powder fouled the gun so much that it had to be cleaned, while the Johnson-Barland powder hardly left a trace.

At the recent Manchester meeting of the "British Association," Mr. J. H. Greathead read a paper on the "City of London and Southwark Subway." From this we learn that the subway will be three miles long. The up and down lines will be in separate tunnels, placed at a sufficient depth to avoid all interference with sewers, etc. Except where the lines pass under the river and wharves, they will run under the streets their entire length. The cable system of traction will be used. The total cost from beginning to end, including land, buildings, stations, equipment, etc., he estimates, will not exceed \$1,000,000 per mile, a small fraction of the cost of the present underground London railways.

THE little railroad between Bienne and Macolin, in Switzerland, is described in the last number of the *Génie Civil*. The road was opened for traffic on the first of last June. Its total length is 1,645 metres, in which length it rises 450 metres. The building of the line necessitated important engineering problems. It crosses two iron viaducts, one 90 metres and the other 120 metres long. A train consists of two cars each, and three trains can be run an hour. Each car is supplied with four distinct safety appliances. The traction is by an endless cable. The construction of the road, not including land, was done under forfeit at a cost of 410,000 francs.

A WRITER for the *Architect* (English) holds that the testing of building stone is the only important one to which chemistry can be put directly in connection with building, and concludes that since it is possible without the aid of chemistry to select a durable building stone, while chemical experiments for this purpose must be supplemented by observation and practical experience, that it is inadvisable to add the study of chemistry to the course of the already overburdened student of architecture, especially since the services of an expert can always be obtained in special and important cases.

THE lead covering of the *fiche* of the Cathedral of Notre Dame, of Paris, has been seriously deteriorated by the action of the acetic acid developed by the rotting of the oak frame upon which the ornamented lead covering is laid.

THE Baltimore Society, aided by an appropriation from the institute, instituted an exploring expedition in Magna Græcia under the direction of Mr. Joseph Thacher Clarke, with whom was associated Dr. Alfred Emerson. The principal work of this expedition was on the site of ancient Croton. Unfortunately, the work here has been suspended on account of legal complications with the Italian Government. Mr. Clarke is now engaged upon the completion of his report on the investigations at Assos. The institute proposes during the coming year to limit its efforts to securing a permanent fund for the endowment of the school at Athens.



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. V.*

(Continued from page 619.)

THE ELEVATORS.

THE elevating apparatus or machine illustrated by Figs. 5 and 6 has a number of new features.

The cylinder A is 33 inches diameter; the travel of the piston and also of the rope sheaves B is 14 feet; the piston is fitted with flexible leather rings of L-shaped section which are expanded outwardly by the pressure of the water. The sheaves C, five in number, are stationary as far as longitudinal movement is concerned. The sheaves B, also five in number, are supported on the shaft of the piston-rod cross-head F, therefore move out and in, from and toward the cylinder A, at every movement of the car. The cross-head with its sheaves is guided and sustained in its travel by the rails G, which are made of heavy T-section cast iron, planed smooth. A lip-piece is bolted to the cross-head and extends down under the outer member of the T-rail, serving to keep the cross-head from rising.

The piston-rod is composed of extra heavy wrought-iron pipe. A scraper is provided in front of the cross-head, angled so as to shove off any tools or other obstructions carelessly left on the rails. On the piston-rod is bolted a projecting arm (not shown), which about midway of its travel engages a small carriage placed on the rails and carrying a cross-shaft on which are strung loose pulleys, their office being to bear up the horizontal part of the rope that would otherwise sag when the water is turned off and cause the dancing motion so often observed in cars when suddenly stopped by the operator. The sheaves, both stationary and traveling, are 44 inches diameter, broad on the face and grooved to receive four $\frac{3}{4}$ -inch ropes. They run on steel shafts, and are each bushed with composition metal and provided with special oil-cups. The small bearing or carrying rollers H, on the ends of the

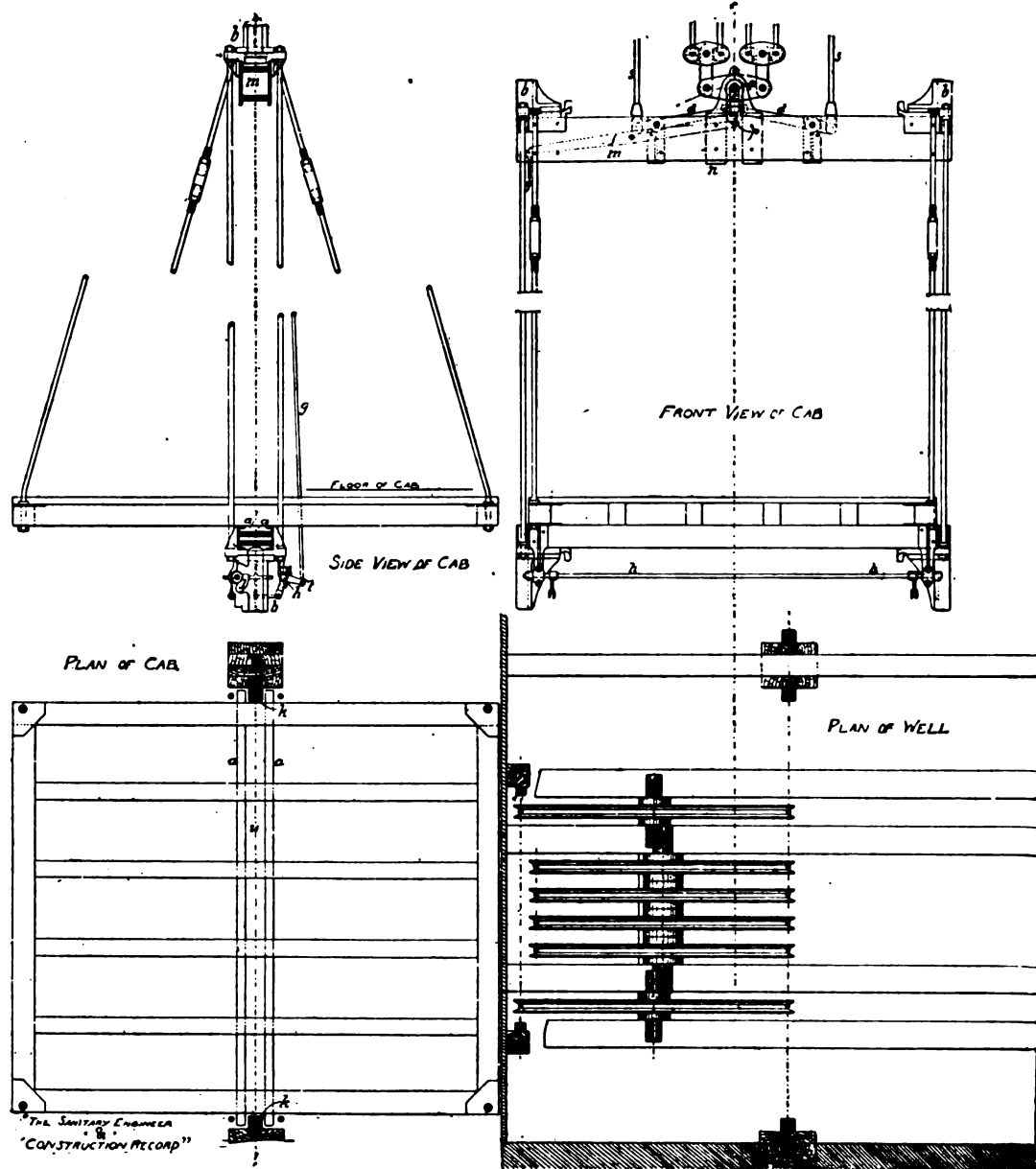


FIGURE 6.

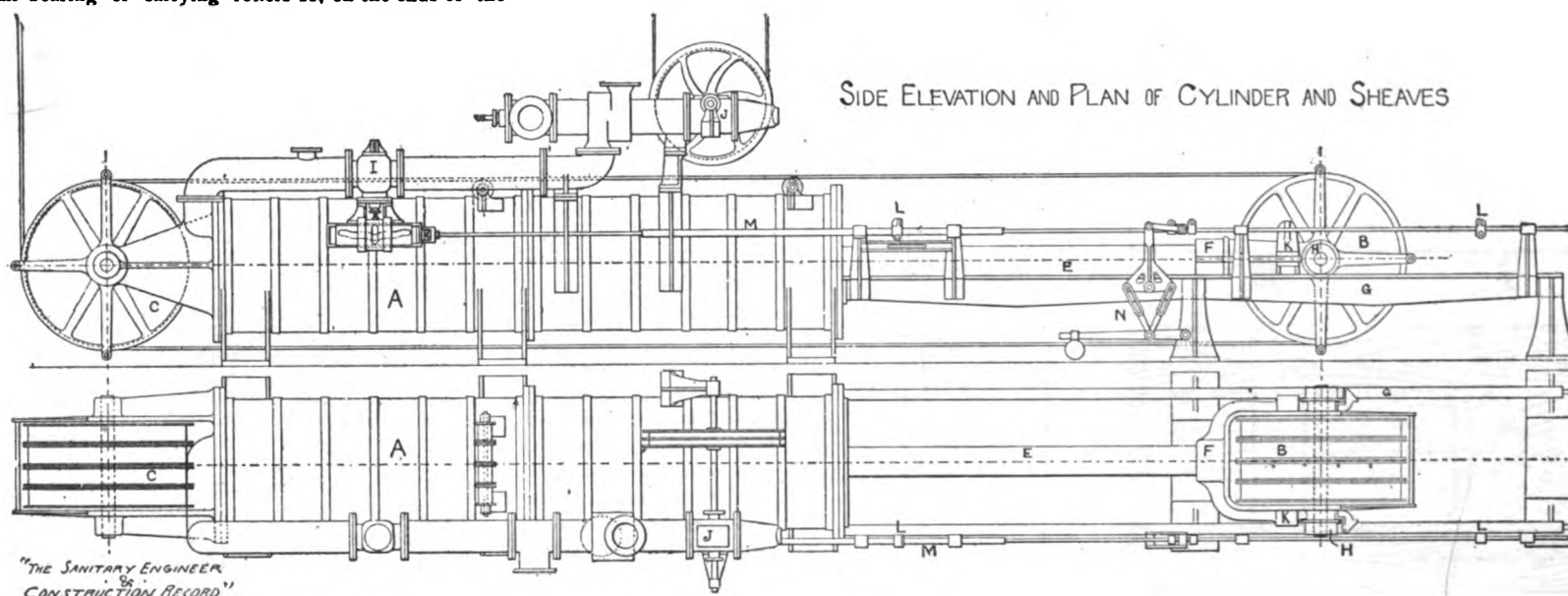


FIGURE 5.

cross-head shaft are 8 inches diameter and turned smooth so that the cross-head may work out and in without jar.

The motion and velocity of the elevator is regulated by a horizontal piston-valve J having a longitudinal motion, operated by a rack and pinion, an endless wire rope $\frac{1}{2}$ inch diameter passing through the car and up over a pair of small sheaves at the top of the well, thence down the well and over a small guide-sheave to 30-inch sheave keyed on the rack-pinion shaft. This furnishes the means of stopping and starting from within the car at any part of

its travel. The cut of the elevator shown in Fig. 5 is a general view, hence the adoption of guide-sheaves and 30-inch sheave and rope, etc., suitable to Equitable Building is not shown. Between this main valve and the cylinder is placed an automatic stop-valve I, for the purpose of partially shutting off the supply of water and insuring an easy and gradual stopping of the car when it has reached a point about six feet from the limit of travel, both up and down. An arm K from the cross-head engaging a stop L, fastened on rod M, is the means by which this is accomplished, the rod being returned to normal position by apparatus N. In case of accident to the main valve or to the operator in the car this auxiliary valve completely stops the run of the piston when the car has actually reached the top or bottom landing, preventing the smash-

ing of the car or cylinder heads. An air-valve opening inwardly is furnished on the body of the regular valve-chamber, its object being to admit air and prevent a vacuum forming when the motion is reversed to discharge water. The discharge-pipe is furnished with a globe-valve at a point near the cylinder for the purpose of regulating the downward speed of the car. The weight of the car is borne by four No. 17 Roebling wire ropes, each taking a fourth of the weight, through the intervention of the equalizing levers P, Fig. 6. This composite rope passes around five multiplying sheaves, making the proportion of car travel to piston speed as ten to one.

The regular working load of the elevators is 3,500 pounds, but by an arrangement of direct pumping into the elevator cylinders Nos. 4 and 9, is made to raise loads of 8,000

*No. I. of these articles, containing the first installment of Sketches of Plumbing, appeared in our issue of October 8; No. II., General Description of Building and Plant, October 15; No. III., Details of Pumps and Boilers, October 22; No. IV., Smoke-Stack and Passenger-Elevator Water-Supply, October 29.

pounds, such as safes and heavy furniture. For this purpose a pressure of 200 to 240 pounds per square inch can be furnished if necessary. The small duplex pump shown at F in the cellar plan is connected for this service as shown on elevator No. 9.

THE CAR.

The frame-work upon which the car proper rests, shown in Fig. 6, contains novel features. The bottom consists of a frame-work of 4x4-inch ash supported by two 4-inch channel-beams *a a*, to which are bolted the cast-steel guide-shoes, *b b*, fitted with an automatic safety attachment, which is operated by the counterweight of the car. The usual overhead cross-beam consists of two wrought-iron plates, *m*, 8x½-inch section. The connection between the cross-beams and bottom is formed by eight bolts—viz.: one, ¾-inch diameter, running to each corner of the frame-work; two, ½-inch diameter, running to cross-bars on each side of the car placed underneath the channel-beams. Guide-shoes are bolted to the cross-beam, which, for purposes of steadiness, are provided with adjustable gibs.

The two bars that compose the cross-beam are held together at the centre by a casting, *n* of strong construction, made of composition metal; to this casting is fastened a system of whiffletrees that insure an equal strain being put upon each member of the composite hoisting rope; if from any cause one member of the rope lengthens more the others, a deflection of the cross-bar or whiffletree gives notice of such change, while the whiffletree, as a whole, is held in the upper part of the slot C, so long as the load of the car is sustained by the hoisting-rope. The counterweights of the car are suspended through the levers, *d d*, in such a manner as to drag the whiffletree to the bottom of the slot the moment the rope breaks. Such action brings the lever *f*, into play, and by means of the connecting-rod *g* the shafts *h h* are revolved sufficiently to bring the teeth of the spiral-surfaced segment *j* against the sides of the guide-rails *k k* with great force, thus holding the car from falling down the well.

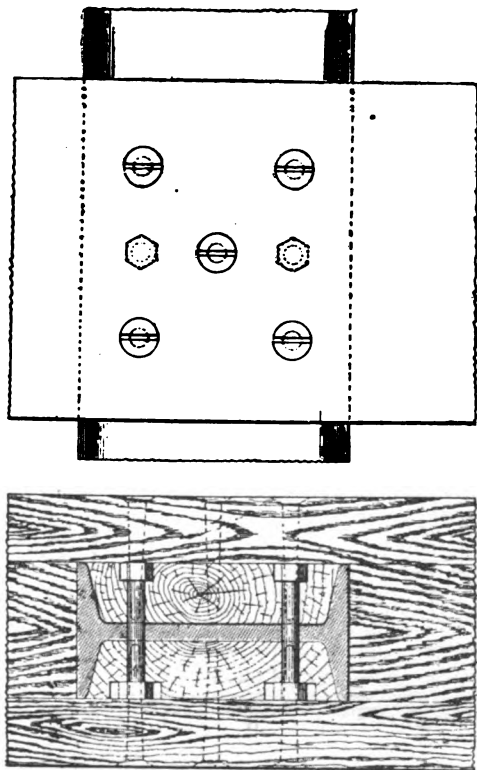


FIG. 7.

The pin *p* carries two links shown in dotted lines; these links are connected at their lower ends by the pin *p*; resting on top of this pin are the long ends of the levers *d d*, while to their short ends are fastened the counterweight ropes *S S*. One end of the lever *f* passes under the same pin, but in its normal position does not touch it; the other end is connected to the lever *f*, by the connecting rod *g g*. Any downward action of the pin *p* through slot C—caused by the breaking of the hoisting rope, etc.—gives instantaneous movement to these levers to produce stoppage of the car, the motive power being the weight of the counterweights. A working car speed of 500 feet per minute is attainable, but the average working speed adopted throughout the building is 350 feet.

THE WELL (FIG. 6).

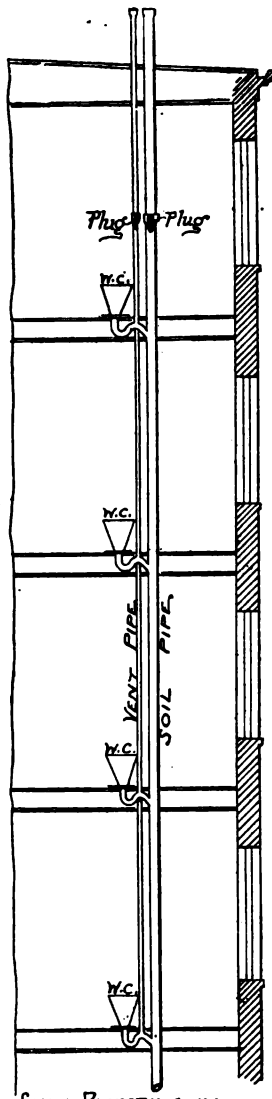
The several wells or shafts in which the elevators work were planned to accommodate two elevators each, so that a central guide-post serves for both, making three guide-posts in each well.

The central posts, 8x10 inches, are made of four pieces of white pine, 2x10 inches, nailed together; this has the advantage of bringing the joints at different places and providing against warping. The guide-rail is made of maple wood in pieces four feet long, tongued and grooved at their ends, and fastened by strong screws to the guide-posts. Coincident with each landing are placed I-beams, *u*, directly across the centre of the well around which the central post is built. This arrangement is shown in Fig. 7. The width of the beam being eight inches admits the outer planks of the post to pass without cutting; the space between these and the body of the I-beams is filled up by blocks bolted into place and made flush with the edges of the beam, thus providing a place for receiving the points of the screws that hold on the outer portion. The two outer guide-posts are built into the wall of the well and are held in place by means of bolts that pass through the posts and are held in the headed slots in cast-iron "bricks" built into the wall at suitable places.

The diameter of the hoisting-rope sheaves, placed at the top of the well and shown in Fig. 6 is forty-five inches. The method of mounting them in place is fully shown in the cut. The I-beams shown are 15-inch; 150 pounds per yard. The shafts are of steel and run in babbited boxes provided with good oiling arrangements. One sheave of the four is keyed to the shaft, while the others are loose to allow for irregularities of stretch in the rope. The diameter of the counterweight sheaves is forty-eight inches, so as to bring the counterweights as close to the wall as they will work. The counterweight is made of cast iron in several pieces and bolted together in place. It is made heavy enough to almost balance the weight of the car and arranged to receive additional weight while in place if found to be necessary. The counterweight rails are at the back of the car-well opposite the entrance doors.

The walls of the well are covered with white-glazed tile. The contractors for the elevators and appurtenances found it advantageous to have a man on the ground to watch the progress of the wells and place the cast-iron bricks with the tee-slots in proper places, and also to see that the I-beams across the well-holes were placed above each other in an exactly vertical line.

(TO BE CONTINUED.)



THE ATTEMPT TO DECEIVE A CINCINNATI BUILDING INSPECTOR.

It has been suggested that we make our account of the attempt to cheat the plumbing inspector of Cincinnati, published in our issue of October 15, more intelligible by a sketch. The accompanying has therefore been prepared to show what the plumber did. It will be remembered the pipes were to be subjected to the water test, and plugs were found in them so that the water could not reach beyond that point, hence the one or two joints above the plugs were all that it was thought necessary to make tight.

THE WINTER'S WORK OF THE NEW TRADE SCHOOLS.

The excellent work of these admirable schools, founded and maintained by Richard T. Auchmuty, Esq., of this city, is now well known to our readers. The instruction is entirely practical in character and adapted to fitting young men to make a living in several of the trades. The seventh season began on October 26. We note below the courses of study.

In Plumbing there will be a night class and a day class, and the instruction will be both practical in the shop and theoretical by lectures on the theory and practice of the art. The day class will take gas-fitting as well as plumbing.

In House-Painting the evening class will study preparing woods for painting, applying the different coats, flattening, polish white, use of various oils and dryers, and study of the harmony of colors. There will be also a day class in House and Sign-Painting.

In Fresco-Painting, instruction, in the evening, leads from the making of lines and shading to elaborate designs. Some of the designs of scholars of previous seasons have been exhibited at the American Institute Fair.

In the Bricklaying Class evening instruction is given in building walls, piers, arches, flues, fire-places, setting sills, corbelling, etc. Instruction is also given in laying face-brick.

The Plastering Class, beginning November 30 and ending March 2, studies scratch coating, brown coating, hard finishing, mitering, etc.

In Stone-Cutting there will be both day and evening classes, in plain and ornamental cutting.

The Carpentry Class will have instruction in carpenters' and joiners' work in the evening. There will also be given instruction in Wood Carving, with evening classes.

The class in Blacksmith's Work will study forgings and vise-work, with instruction in the management of fires, drawing down, welding, riveting, etc., and filing, fitting tongues and grooves, and other handiwork.

Under direction of the Merchant Tailors' Society of the City of New York instruction will be given in all branches of the tailoring trade.

Information in addition to what is given can be obtained by addressing the New York Trade Schools, Sixty-seventh and Sixty-eighth Streets, New York City.

A FIRE FROM GASOLINE IN A VAULT.

Our Milwaukee correspondent writes: "Fire nearly destroyed Jacob Winkler's plumbing and gas-fitting store. A boy went to a gasoline barrel under the sidewalk and lit the gas. The vapors arising from the gasoline caught fire and a fierce conflagration resulted. To make matters worse the lead connections at the meter melted and the escaping gas helped the fire. It was finally put out by shoveling loads of sand in the coal hole. Chief Foley thinks that all buildings should have a box to the sidewalk to shut off gas in case of fire."

SALARIES OF HOUSE-DRAINAGE INSPECTORS.

OFFICE OF THE BOARD OF HEALTH,
PHILADELPHIA, October 24, 1887.

SIR: Please inform me through your valuable paper if you have the data of what the different cities pay their inspectors of house-drainage and ventilation. By so doing you will confer a favor.

Yours respectfully,

INSPECTOR.

P. S.—Philadelphia pays one thousand dollars.

[In New York the inspectors of plumbing and drainage receive \$1,260 per annum, with the exception of two special experts who receive \$1,600. Each of said inspectors is required, in addition to plumbing and drainage, to inspect tenement-houses as to light and ventilation. The average number of houses in each inspection district is about 300. In the opinion of those well able to judge, the amount of salary is inadequate for the service rendered and the skill necessary to properly discharge the duties of the position.]

A WOOD-BURNING HEATING-BOILER WANTED.

FORT SHERMAN, IDAHO, October 18, 1887.

SIR: I want a wood-burning boiler for steam-heating a house of ten to twelve rooms, the same boiler to supply hot-water for bath-room. All the boilers advertised are either for hard coal, soft coal, or coke. These are not procurable here except at great expense. I request the benefit of your advice as to kind of boiler and the necessary arrangement of the system. The following is a rough sketch of first and second floor plans.

Two rooms in attic, cellar under whole house. Wood available, yellow pine. House faces south.

Please give this subject any attention you can and reply in THE ENGINEERING AND BUILDING RECORD as answer to correspondent. Respectfully, J. A. L.

[We cannot recommend the burning of wood for house-heating under a steam-boiler. It is next to impossible to control combustion and the pressure of the steam automatically and safely when wood is the fuel. If you wish to try the experiment use a pipe-boiler of some kind, such as the Nason & Blake, that has a long furnace, and see that the brick-setting and doors are absolutely air-tight. The latter can be planed and fitted, but to make the former tight two walls must be built: the first one, say eight inches thick, thoroughly coated with tar or bitumen; then one of four inches built against it. Opening the fire-door of a wood-fed boiler will not check the steam, hence you must depend entirely on the lower door. In other respects fit your apparatus as you would for coal.]

MAKING VERSUS BUYING SOLDER.

SIR: Would you kindly devote a small space in your paper to inform me, a constant subscriber, of the method of making solder from old joints, and also if it is any saving from buying from manufactories, and oblige,

JOHN BUTLER.

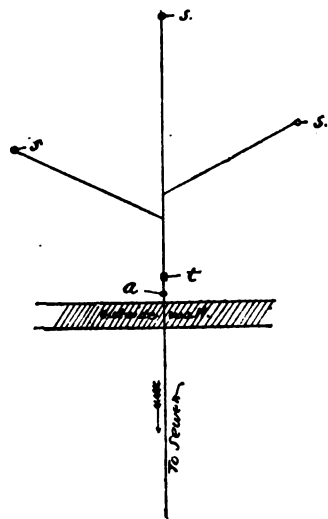
[We believe it cheaper for a plumber to sell the old joints to solder manufacturers and buy solder than to try to make it—at least in cities where there is market for the joints. The trouble in making solder from old joints is that the purity of the lead from which the lead pipe was made cannot be relied on, old lead often being used in manufacturing pipe. Manufacturers of solder on a large scale, however, have facilities for refining the metal they use that individuals do not possess.]

ON VENTILATING SOIL-PIPES.

BOSTON, October 21, 1887.

SIR: Suppose the basement drains in a building to be laid out as shown on accompanying diagram, 4-inch soil-pipes running down from closets on floors above at points *s s s*. A running trap is located at *t*. Now, if an air-pipe were run from drain at point *a*, outside trap *t*, up through roof, would not this obviate the necessity of carrying each vertical run of soil-pipes *s* through the roof? What advantages, if any, would the latter plan offer over that shown in the diagram, and if the plan shown in diagram is feasible, how large should the vertical air-pipe be?

INQUIRER.



[The pipe to run through roof from point *a* would be of no use to protect the traps on the branches *s s s*. If the pipes at these branches did not extend through roof they would be practically "dead ends"—that is, there could be no movement of air through them, and the seals of the traps could not be maintained. The fixtures should be placed on short branches from a vertical pipe which extends through the roof. The pipe at *a* may be dispensed with as a needless expense.]

A CASE OF FRACTURE OF TERRA-COTTA.

WE received the following inquiry from an architect of N. Y. City, which touched a matter of sufficient interest to justify careful investigation:

"Can you or some of your contributors inform me of the probable cause of the destruction of the terra-cotta work on the east front of the Produce Exchange in this city? It is especially noticeable in the voussours of the third-story arches, where pieces having an average area of some two square feet have seemingly scaled off, exposing the core and backing.

"Yours respectfully, ARCHITECT."

A representative of this journal has investigated the matter and reports as follows:

The abutting faces of the voussours, or arch blocks, are concave, a lip about an inch wide projecting all around the face nearly one-half an inch, giving a mortar-joint one inch thick or more at the centre, and a quarter of an inch or less between the lips. Mr. Armstrong, of Moran & Armstrong, who did the mason-work on the building, stated that this was nearly the last portion of the work completed, and that it was done in unfavorable weather, and while the terra-cotta may have been defective, he is inclined, for the above reasons, to believe that the failure is due mainly to imperfect filling of the joints, which, permitting undue pressure on the projecting lips, caused the fractures. Mr. George B. Post, the architect, says: "An examination shows conclusively that the main trouble lies in the fact that the blocks were not thoroughly filled with concrete before they were set. It may be in some cases that the terra-cotta was not perfect, but that is a matter which it is difficult to determine, even by close inspection after it is broken."

These statements, though assigning somewhat different causes for the trouble, are not contradictory, but mutually corroborative, as the ultimate cause is probably the same in each—viz., hurried work toward the close of a large job and bad weather.

The superficial scaling, which appears in some places, is due, according to the manufacturers, to an attempt on their part to improve the color of the blocks by coating the surface before burning with a wash of finer clay of better appearance, but not strong enough to form the body of the blocks. This has in some cases since peeled off, but does not in the least affect the strength of the work.

The lessons from this incident, however, are obvious. Terra-cotta requires careful filling and careful bedding; if either is deficient there will be trouble, and, in filling the blocks, it should be remembered that some cements expand in setting, and hence are liable to burst the terra-cotta.

PROTECTING WALLS OF BATH CELLS.

COLORADO SPRINGS, COL., October 19, 1887.

SIR: Can you inform me what kind of paint to use on wooden partition walls for bath-cells, where the paint or varnish cover is exposed to the hot vapor of water containing sulphurous and iron salts?

Or can you recommend any other kind of finish for such walls? I have been consulted in regard to the wall finish for a projected sanitary plant at Glenwood Springs and have recommended for floor finish "Seyssel" or "Neufchatel Rock Asphalt" and hard brick partitions with soapstone finish, but the management prefers at the latest date wooden partitions.

Any information you may favor me with will be duly appreciated by

TYRO.

[If wooden partitions are used we know of no paint or varnish which will give satisfactory results. Hard tiles or enameled bricks have been used for walls of steam baths with good results. Soapstone finish for walls has not been tried under such circumstances, but it would probably do well.]

IF "Old Subscriber," who inquired about dampness on inside walls, will give his name and address so that we can obtain further particulars, we may be able to answer his query.

PLUMBING IN PHILADELPHIA PUBLIC BUILDINGS.

(Special Correspondence.)

THE Board of Directors of the Master Plumbers' Association has elected William M. Wright president of the association to fill the vacancy caused by the resignation of Mr. W. E. Lindsley.

The work of fitting up the third floor of the new public building of this city is now being pushed rapidly forward and it will be shortly ready for occupancy.

A novel feature of the fittings of this floor is the use of polished granite for the back and sides of the urinals. This is said by one of the architects to be among the first used for that purpose in the country.

The architects have also discarded the use of traps on the urinals and water-closets of this floor and are ventilating the water-closets into a large chimney.

THE *Chronique Industrielle* contains an interesting account of the first electric-power vessel constructed in France. It is propelled by a dynamo-electric machine, the invention of Captain Krebs.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING of the society was held Wednesday evening, November 2, at which several resolutions for making changes in the constitution were presented, and the following were read by the Secretary:

At a meeting of the society, held at the Hotel Kaaterskill July 6, 1887, a resolution was adopted that it is expedient to create a grade of students of the society, said grade to consist of young men over eighteen and under twenty-five years of age.

Also the following: That a committee of five be appointed to consider and report at the meeting on the first Wednesday of October, 1887, the advisability of adding a new grade of membership.

A committee was then appointed by the President.

At a meeting of the society, October 5, 1887, the following report was received from the majority of the committee: *President and Members of the American Society of Civil Engineers.*

Your committee appointed under a resolution adopted at the meeting of the society held at Hotel Kaaterskill, July 6, 1887, "To consider and report at the meeting on the first Wednesday of October, 1887, the advisability of adding a new grade of membership to be called 'Students,' and what alterations of the Constitution and By-Laws will be required to establish such a grade," respectfully reports: That we have prepared and submit herewith amendments to the Constitution, and a resolution fixing the dues to be paid by those who enter the proposed grade.

In considering the advisability of creating this new grade of membership, we have taken into full account the only objection that has been raised to such action—that it would lower the standard of the society. If there be danger of such result, then your committee would certainly report that the proposed action is not advisable. If membership of the society is to remain as now established, then to add a lower grade would, in a certain sense, lower the average of the society, and so afford some ground for the objection. If, on the other hand, the creation of a new grade is made the occasion of an advance in the standard of qualification for the higher grades, then the spirit of the objection is an argument for the proposed action. Another consideration influences your committee, which is, that we find scant room for a grade of students below the requirements for the present class of Junior. We therefore say, decidedly, that if the society is unwilling to raise the standard of qualification required for membership in grades now established, then it is inexpedient and not advisable to create the proposed grade of students.

But if the society is ready to raise the standard for all grades, then we say the creation of the proposed grade of students is expedient and advisable.

To test the disposition of the society, and with confidence that it is ready for a step in advance, we report in favor of the adoption of the accompanying amendments and resolution. Robert E. McMath, Chairman; Robert H. Thurston, W. H. Paine, Robert Moore.

The active members of the society shall be divided into three classes, to be styled respectively members, associate members, and associates.

Associate members shall have all the rights and privileges of members excepting the right to hold office or to vote upon admission to membership. Associates shall have all the rights and privileges of members excepting the right to hold office or to vote.

There shall also be a preparatory grade, to be designated Students of the Society, who shall have the right to attend all meetings not strictly devoted to business and to use the library and rooms of the society under such regulations as the Board of Direction may adopt. They shall have by right the Transactions of the Society, and the privilege of presenting papers and written discussions.

Members of the Class previously styled Juniors shall, after March 7, 1888, be classed as Associate Members.

A Member shall be a Civil, Military, Mining or Mechanical Engineer, not less than thirty years of age, who has been in active practice as such for at least ten years, or has graduated at a School of Engineering after a full course of study and been in practice seven years, and who continues in actual practice at the time of application for membership, and who has had responsible charge of work as Chief, Resident, or Superintending Engineer for at least two years, not as a skillful workman merely, but as one qualified to design as well as to direct engineering works.

An Associate Member shall be one over twenty-four years who has had actual practice in some of the branches of Civil, Military, Mining or Mechanical Engineering for at least five years; or, if a graduate of a school of engineering, after a full course of study, who has practiced at least two years.

An Associate shall be one over twenty-five years of age, who is a manager of a railroad, canal or other public work; a geologist, chemist or mathematician; a proprietor or manager of a mine or metallurgical works; an architect or a manufacturer; or one who, from his scientific acquirements or practical experience, has attained eminence in his special pursuit, qualifying him to co-operate with engineers in the advancement of professional knowledge; but shall not himself be practicing as an engineer.

A Student shall be one not less than 18 years of age, who is engaged in the study of engineering with the intent to become an engineer and who has pursued that study at a technical school not less than one year, or who shall have been engaged in the study and practice of engineering under a competent engineer for not less than two years. A student shall not remain in that grade for more than seven years; if not elected to a higher grade his connection with the society shall terminate at the end of seven years.

In the event of the society adopting amendments to the Constitution creating the grades of associate member and students of the society, that the entrance fee and annual dues of associate members shall be the same as established for associates; for students no entrance fee shall be required, and the annual dues shall be, for resident students, ten dollars, and for non-resident students, six dollars per annum.

Report of committee stating reasons for the several changes and alterations in the constitution that are proposed:

Designation of Classes.—It will be observed that the designation of the several classes is similar to that of the Institution of Civil Engineers, and, we may say, also to that adopted by the recently organized "Canadian Society of Civil Engineers." Uniformity of designation and in the standard of qualification for the several grades ought to be aimed at by the leading engineer societies; we think these designations appropriate.

Definition of Rights.—We think it well to give associate members superior rights to associates, but materially less than members. The rights of students are secured.

Junior classes abolished; its members transferred to associate members.

This change will work no hardship, except to those who are enamored with the lower grade. The society should put pressure on such to move along. Some of the recent admissions to the junior class will get into associate membership under age, but this is no hardship to them.

Qualifications for Membership.—The age specified, 30, is thought by your committee to be a fair compromise between various suggestions, mostly higher.

The thought is, that admission to full membership is a final endorsement by the society of the man, and that his character should be fixed by experience under the test of actual life for several years. Membership will thus have a meaning and value, and its attainment will be an object to be sought. In the experience qualification the aim is to give decided preference to those who enter the profession with the advantage of a technical education. The extension of experience from 7 to 10 years and responsible position from 1 to 2 years is an intended advance in the required qualifications.

Qualifications of Associate Members.—This is a decided advance in age and experience over that required for the present class of junior.

Qualifications of Associates.—Except the requirement of 25 years, the qualification for this class is unchanged.

Qualifications of Students.—A decided advantage is allowed the student from a technical school, since there is now little excuse for any young man who would enter the profession without the advantage of a technical education. We have thought it well to fix a time, instead of age, limit to continue in this grade, otherwise those who graduate young and immature would have the advantage of older students. The grade of associate member should be fairly open to the student before his studentship terminates.

Nomination and Election of Students.—But one endorser is required, and he may be of any grade higher than student, because young men cannot be well known except

by those with whom they have been associated in the capacity of pupil or subordinate.

Their election is left to the Board of Direction to emphasize the fact that students are not members of the society, but are probationers, and subject to the Board of Direction for admonition and discipline.

Mr. Fred. Brooks, member of the committee, presented proposed amendments differing from those presented by the majority of the committee and retaining the name of junior.

A resolution was presented relative to admitting engineers not resident in North America who may not be personally known to five members, and may be endorsed by five members of Board of Directors who shall secure evidence sufficient to show that the candidate is worthy. This was signed by Theodore Cooper, W. R. Hutton, A. D. Foote, P. J. Sosa, J. P. Davis.

An amendment was proposed relative to balloting for members, which required that when a candidate had been rejected, and the Board of Directors should receive written application from eight members stating reasons therefor, and if deemed sufficient another ballot to be ordered. This ballot to be an open one and five negatives to exclude. Signed by Theodore Cooper, F. A. Calkins, D. McN. Stauffer, L. L. Buck, J. P. Davis.

The following amendment was also introduced, that members shall be elected by a two-thirds vote of the Board of Direction, which was signed by J. J. R. Croes, G. S. Greene, Jr., D. McN. Stauffer, O. H. Nichols, C. W. Hunt.

After the above were presented the result of ballot for members was announced, and the following were elected as members in their several classes:

For Members.—George Earl Church, Civil and Consulting Engineer, London, Eng.; Henry Stevens Haines, Chief Engineer and General Manager Savannah, Florida and Western Railroad, and Chief Engineer and General Manager "Plant System," S. F. & W. R. R., Savannah, Geo.; David Carlisle Humphreys, Adjunct Professor of Applied Mathematics in Washington and Lee University, and U. S. Assistant Engineer with Missouri River Commission, St. Louis, Mo.; William Datus Kelley, Jr., Special Assistant Engineer on New Croton Aqueduct, Tarrytown, N. Y.; Rowland Robinson Minturn, Assistant Division and Locating Engineer, Chicago, Milwaukee and St. Paul Railway, Milwaukee, Wis.; James Moylan, engaged in general practice of Civil Engineering, New York City; Cornelius Palmer, Superintendent of Bridges and Buildings Chicago and Northwestern Railway, Escanaba, Mich.; William Barclay Parsons, Consulting Engineer, New York City; Edward Fesser Playle, Assistant Engineer in charge of Shafts Nos. 21, 22, and 23 New Croton Aqueduct, Morris Dock, New York City; Albert Fowler Robinson, Bridge Engineer, Chicago, Burlington and Northern Railroad, St. Paul, Minn.; Orlando Belina Wheeler, U. S. Assistant Engineer in charge Triangulation party under Missouri River Commission, St. Louis, Mo.

For Associate.—Arthur James Moxham, President Johnson Steel Street Rail Co., Johnstown, Pa.

For Juniors.—Archie McLean Hawks, Assistant Engineer Randolph Bridge, Chicago, Milwaukee and St. Paul Railway, St. Louis, Mo.; Downing Vaux, with Department Public Works, in Bureau of Sewers, New York City.

REPLACING STONE TOWERS OF THE NIAGARA RAILWAY SUSPENSION BRIDGE WITH IRON TOWERS.

A paper was presented by L. L. Buck, Mem. Am. Soc. C. E., on "Replacing the Stone Towers of the Niagara Railway Suspension Bridge with Iron Towers." This bridge was completed in 1855, and the writer states that the stone towers rested on the rock which forms the banks of the gorge spanned by the bridge. On the New York side the towers were about ninety feet high and on the Canadian side eighty feet high. The base of the towers was very large, composed of rock-faced ashler, extending nearly to the level of the upper chords. The towers on each side of the river were double, and the portion above the base was fifteen feet square at base and eight feet square at top.

The stone used was limestone, quarried near the site of the bridge. A few of the first stones laid at the bottom of the towers were from the surface, and all remaining stones were taken from a stratum below, and did not bear exposure to the weather. This defect developed some time after completion, and irregular-shaped pieces would become detached, and cracks appeared in various parts of the surface. Painting was resorted to as a preventative and continued at intervals as long as the towers were retained.

While work of rebuilding the suspended superstructure was in progress in 1880 the writer noticed that the most defective portions of the towers were those located one-third of the distance from the level of the railway floor to the top, and the disintegration decreased as the distance

above and below this point increased. This could only be accounted for by supposing that the towers were being subjected to a considerable bending stress, which would be greatest at this point, that opened the joints and admitted water, coupled with increased pressure at the surface, and bad character of the stones would partly account for it.

The cause of this bending stress was the elongation and contraction of the cables between the towers and the anchorage, produced by live-load stress and changes of temperature. The maximum movement at the top of the tower produced by the live load is about $\frac{1}{4}$ of an inch, while that produced by temperature between extremes is a little over two inches. As these two forces act in concert only at the maximum temperature, it is evident that the greatest movement of the saddle at maximum temperature would be about $1\frac{1}{4}$ inches from its normal position and toward the river, while in the opposite direction it would move from the normal position to that at minimum temperature about one inch. In 1880 the greatest movement of the saddles with respect to the bed-plate was $\frac{1}{8}$ of an inch, and the repairs to suspended superstructure was completed at this time.

The only plan for repairing the towers that promised success was the cutting away of defective portions of the stones to various depths, or till the sounder portions within were reached, and then reface the towers with new stones, thoroughly anchored to the interior portion, and cement and grout all interstices. This refacing was completed in the fall of 1883, the last tower repaired being on the Canadian side. On returning from the West late in the fall cracks of a serious nature were found in the last tower repaired. One crack started at the middle of the top of the south side, and the other at the middle of the top on the westerly side both extended downward, gradually approaching the south-west corner, where they met at a point above the railway floor about one-third the height of the tower above the floor.

In September, 1885, the north tower on New York side was apparently in fair condition. The south tower on the same side had opened some of its joints slightly, and two or three of the new facing stones were slightly cracked. On the Canadian side the south tower had some open joints, and several new stones were cracked. A serious crack also started in the old stones on the east face, beginning about twelve inches from the north-east corner, thence extending upward and toward the middle of the face through three courses. As the old stones were larger than the new this was more serious.

The north tower was in a far worse condition than any of the others, as many of the joints of the new face stones opened, but on the south and west faces many of the stones were so badly cracked that some appeared ready to fall out.

At this time motion of the saddles on the rollers had nearly ceased. All of the rollers on top of one tower only covered an area of $3\frac{1}{4}$ inches by 4 feet 7 inches, equal to 17.18 square feet. The bed-plate could not effectually increase the area of distribution of the weight to more than 25 square feet. The maximum weight of about 900 tons resting on the rollers would cause a pressure of 35 tons per square foot on the masonry. The trouble proved of such a serious character that plans were prepared for replacing the stone tower with iron, of which the following is a brief description. Each iron tower is made up of four wrought-iron columns braced transversely and longitudinally by wrought-iron struts and rods. Each column is supported by a limestone pedestal resting on the rock and capped with granite. The outer portions of the old bases were cut away to make room for the new pedestal. The tops of each pair of columns were connected by a heavy web-plate secured to each web of the columns by angles and rivets. On the caps of the two pairs of columns rests the main bed, built up of wrought-iron plates and angles. It is in plan 9 feet 2 inches by 5 feet 3 inches, and weighs $9\frac{1}{2}$ tons. On this is placed steel plates with long side parallel with direction of cable, on which 18 steel rollers are laid each 4 inches in diameter, covered by a cast-iron plate 7 feet by 2 feet 4 inches by 18 inches in height.

The transferring-apparatus consisted of four cast-iron columns, two transverse and two longitudinal girders, six 125-ton hydraulic-jacks, wrought iron Shim plates, and No. 8 cast-steel wire.

The writer then gave a very interesting detailed description of the process adopted to erect the iron towers and

transfer the cables to them, and removal of the stone in the old towers.

The total weight raised by the six jacks was about 650 tons, each jack being operated by two men. In cutting away the faces of the old towers at the top, the stones were found to be cracked through vertically. In removing the three upper courses the interior stones were found to be sadly shattered in every direction. While the stones were thus broken up, the cement gave indications of having been excellent.

The old rollers were found imbedded in cement and iron rust; the spaces between them and between their ends and ribs of the bed-plates being filled with this cement, which had become so firm that a chisel-bar was required in extracting the rollers. Each roller was in a trough from which no water escaped except by evaporation. While this cement had originally allowed the rollers some motion, the corrosion caused by the water operating upon the iron surface kept clean by the heavy rolling pressure had flattened the bottom sides of the rollers more than one-thirty-second of an inch, and produced depressions in the bed-plate to the depth of three-thirty-seconds of an inch.

The removal of the old stone was a tedious process, and the writer did not know of any whole stones being found.

THE MINNEAPOLIS ENGINEERS' CLUB

At the last meeting of the club Horace E. Horton, of Rochester, was elected to membership, and the names of Peter Howe, John Brawley, and George W. Ferris were proposed. Mr. James Rigby read a paper on "Gas and Light." He showed how vast had been the progress in artificial lighting, and yet how little understood the subject is at present. He had with him some interesting drawings. The club will hold meetings semi-monthly during the winter.

THE NEW YORK ARCHITECTURAL LEAGUE

At the last meeting of the New York Architectural League, the following gentlemen were elected members: A. F. D'Oench, Superintendent of the Building Department, Mr. Bright, A. E. Barlow; non-resident members, J. W. Root, of Chicago; H. C. Burdette, of Buffalo.

THE NEW CHICAGO PUMPING-ENGINES.

The Commissioner of Public Works has received the following report from Committee of Experts on trial of the new Gaskill engine:

CHICAGO, ILL., October 29, 1887.

Hon. George B. Swift, Commissioner of Public Works, Chicago, Ill.

SIR: The undersigned, the committee appointed by you to make a trial of the new Gaskill pumping engines now in operation at the North Side pumping station, beg leave to submit the following report of the results obtained.

A trial of each set of machinery was made, beginning on Monday, the 24th inst. with the west pair of engines, the trials being of twenty-four hours duration each, that period having been adjudged by the committee sufficient to settle the questions referred to it by the city. A supplementary trial was also made of the engines first tested, to determine the efficiency of the boilers and the distribution of heat in the engines. The data obtained and the calculated results will be submitted in full detail later.

The conclusions of your committee are as follows:

The contract made with the Holly Manufacturing Co., of Lockport, N. Y., the builders of the engines, binds them to furnish two sets of pumping machinery, each capable of delivering 12,000,000 gallons of water per day of twenty-four hours, against a head of one hundred and fifty feet, the piston speed not exceeding one hundred and twenty feet per minute, and to develop a duty of not less than 95,000,000 foot pounds per 100 pounds of coal burned in the boilers, no allowance for ashes or any other wastes being made.

The contractors are also called upon to furnish engines of good design, construction, and material.

Your committee find upon test that the engines furnished by these contractors are of good design, of excellent workmanship, and, as far as they have been able to judge by inspection, of the best of material. This committee are also able to certify that the stipulated capacity has been secured and that the duty actually obtained is considerably above that demanded, exceeding 100,000,000 foot pounds of work done per 100 pounds of coal consumed.

Very respectfully,

R. H. THURSTON, J. S. COON, JAMES N. WARRINGTON, Committee.

THE LEVEL OF THE NEWPORT SEWER.

The committee of experts appointed to find out whether Newport's main sewer ran up hill anywhere have been able to report a very satisfactory negative. The sewer is at all points either level or inclined toward its outlet.

THE HARLEM RIVER IMPROVEMENT.

The work on the Harlem River improvement at Two Hundred and Twentieth Street, for which proposals are invited in our advertising columns, and for which Congress appropriated \$400,000 at its last session, is but a small portion of the whole work, which contemplates eventually the formation of a navigable channel from 350 to 400 feet wide, and from 15 to 18 feet deep, from the East River to the Hudson River, by the way of Harlem River and Spuyten Duyvil Creek.

The chief work will consist of a rock cut through Dyckman's Meadow connecting the Harlem River and Spuyten Duyvil Creek, and an earth cut through the meadow south of the rolling mill and Johnson's foundry on Spuyten Duyvil Creek, with such protection for the sides of the cut as may be needed to prevent the banks from washing away, but owing to the smallness of the appropriation, the present work will be confined to a portion of the rock cut.

The material to be excavated in the cut is dolomite, a limestone known in that neighborhood as Westchester marble, with a covering of mud, earth, sand, or loose rock, varying in depth from about 10 feet to nothing.

The present elevation of the ground varies from about 6 feet to 63 feet above the plane of mean low water at that point.

The work must be commenced within twenty days after the contract is signed, and completed by September 30, 1888.

THE NEW PENSION BUILDING.

The report of General M. C. Meigs, the architect of the new Pension Building, dated September 3, 1887, contains some interesting figures. The ground plan of this building includes 80,000 square feet, its floor areas 188,258 square feet, and the contents of the outer skin of the walls 8,211,502 cubic feet. There were 78,800 tons of material used in its construction, including 15,500,000 brick. Its cost per cubic foot of space was 10 $\frac{3}{4}$ cents. The space heated and ventilated, excluding the cellar, is 6,170,200 cubic feet. The ratios of heating surface to space heated are, in southern rooms, one square foot to 111 cubic feet; in the northern rooms, one square foot to 135 cubic feet; in the eastern rooms, one square foot to 123 cubic feet; in the great central hall, one square foot to 777 cubic feet.

The hall, containing four million cubic feet of space, is the regulating air-reservoir. The fresh air is introduced through the window-sills over steam-radiators placed in the window-breasts. The consumption of fuel has been about 700 tons per year.

While the external appearance of the building is not generally admired, and few architects would be willing to take it as a pattern, it seems well adapted to its purpose, being well lighted and ventilated, and conveniently arranged for the large force of clerks employed in it.

THE MYSTIC RIVER INVESTIGATION.

The Massachusetts State Board of Health has appointed Phineas Ball, C. E., of Worcester, H. A. Carson, C. E., of Boston, and Charles H. Swan, C. E., of Boston, a committee to investigate the sewage pollution of the Mystic River and means of prevention. The Engineer of the Board of Health is F. P. Stearns, C. E.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
October 29.....	24.84	20.45	21.80	28.43	30.11	25.73	29.

E. G. LOVE, Ph.D., Gas Examiner.

The New York District Railway Company claims, in a circular letter, that the Court of Appeals has affirmed the constitutionality of the act under which it is organized. We note that a similar claim is made in the daily papers for the Arcade Railway. The money to carry out either of these schemes, however, is not forthcoming.

AN ACCIDENT AT THE NEW WATER-WORKS AT LITTLE ROCK.

PRESS dispatches state that the new water-works recently constructed by Colonel Zeb. Ward, at Little Rock, Ark., were to have been opened November 2, but, at 10 o'clock, the centre wall dividing the two new reservoirs, placed on a mountain 250 feet above the city, gave way, and allowed 10,000,000 gallons of water to run back down the mountain-side into the river. The lower reservoir was full, and the water from the upper rushed into it and caused it to overflow. The damage is \$10,000.

KIND WORDS FROM OUR CONTEMPORARIES.

WE are pleased to quote the friendly references of several of our esteemed contemporaries to our recent change of name:

[From the *Railroad Gazette*.]

"In noting this change of name we offer Mr. Meyer our congratulations on the success of his admirable journal, and assure him of our good wishes for its future. THE SANITARY ENGINEER has always been edited with a high ideal. No effort has been spared to make it the organ of the best opinion in the specialties it has treated, and it stands as a fine example of clean and able journalism."

[From the *Railroad and Engineering Journal*.]

"While a change in name of an established paper should always be avoided, if possible, there are in the present case some strong reasons for it. The new name expresses much better the real character and scope of the paper, while the old one was to some extent misleading, as indicating a more contracted field than that really occupied. THE ENGINEERING AND BUILDING RECORD is a paper whose excellence and independence merit continued prosperity, and should secure for it a wide circle of readers."

[From the *American Machinist*.]

"Our staunch and reliable contemporary, THE SANITARY ENGINEER, has changed its title, and will hereafter be known as THE ENGINEERING AND BUILDING RECORD, retaining the old name as a sub-title. We are more than persuaded that the character of our contemporary will undergo no change, so far as reliability and sterling integrity are concerned, and congratulate it upon having secured upon its editorial staff the services of Mr. H. W. Brinckerhoff, a member of the American Society of Civil Engineers, and a gentleman of well recognized talent, who will help to make the paper even more attractive than ever. We congratulate THE SANITARY ENGINEER upon the enviable position it has attained, and predict for THE ENGINEERING AND BUILDING RECORD still greater success."

PERSONAL.

MAJOR DALLAS BACHE, Surgeon U. S. A., has been transferred from Newport, R. I., to Fort Riley, Kansas.

LIEUTENANT OSCAR T. CROSBY, of New York City, resigned last week from the Engineer Corps of the Army.

HENRY B. HARRISON, architect, of Newark, N. J., died recently.

JOHN C. DAVIS, master builder for the Baltimore and Ohio Railroad, died November 1. He was born in Luzerne County, Pa., and was sixty-nine years old.

CAPTAIN F. A. HINMAN, Corps of Engineers, U. S. Army, for several years past in charge of the harbor improvements at Norfolk, Va., has been granted a leave of absence. He is the recipient of a letter enclosing a copy of very flattering resolutions, passed by the State Harbor Commissioners, showing their high appreciation of the services he has rendered the State in the work of harbor improvements carried on under his direction.

A REPORT is out to the effect that A. Gottlieb, of Chicago, of A. Gottlieb & Co., expects to buy an interest in the Mt. Vernon Bridge Company, Ohio, and locate there with them. The facts are that Mr. Gottlieb and his partner have become stockholders. He is the consulting engineer of the company, but remains in Chicago.

MR. E. F. FARRINGTON, of Brooklyn, Master Mechanic of the East River Bridge during the whole period of its construction, has accepted a similar position on the new dry-dock to be constructed at the Brooklyn Navy Yard by J. E. Simpson & Co., of this city.

MR. WILLIAM RUMBLE, of Bayonne, N. J., a member of the American Society of Civil Engineers, and for many years connected with the New York Steam Company as assistant engineer and superintendent, has opened an office at 22 Cortlandt Street, New York, as consulting civil and mechanical engineer.

E. TOWNSEND MIX, the well-known architect, of Milwaukee, is dangerously ill with an attack of congestion of the lungs. His work has given him a widespread reputation.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

RAILWAY DEPOT AT HARTFORD.—The plans submitted by Shipley, Ruttan & Coolidge, successors to the late H. H. Richardson, of Boston, Mass., have been adopted by the committee for the New York, New Haven and Hartford Railway depot here, somewhat modified. The building material bids will be made on the basis of several kinds of stone, but some sort of granite in harmony with the surroundings will probably be chosen. The original plan presented a building to be built of red-veined granite, giving it a warm and stately appearance. It would have cost \$400,000 to have realized this plan, and so the change was made to fit \$150,000 or \$200,000.

SEE our "Proposal Columns" in regard to an advertisement calling upon architects to submit plans and specifications for the new New York City municipal building recently referred to in this column.

MADISON SQUARE GARDEN.—In the competition for plans for modifying this well-known resort of New York City, noticed recently by us, the prize plan has been ascertained to be that of Messrs. McKim, Mead & White, architects, of New York City. The estimated cost is \$1,500,000.



For works for which proposals are requested see also the "Proposal Column," pages 633-639-640-656.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

HARRISVILLE, MICH.—Our correspondent writes: "There has not been anything done yet. Don't think there will be this fall."

WEST BRANCH, MICH.—Our correspondent writes: "There has been a little talk about water-works, but nothing done as yet."

MONTREAL, CAN.—Our correspondent writes: "On September 30, at a meeting of the Water Committee, the Superintendent reported in favor of laying larger water-mains in certain streets for improvement in the fire-service. The Committee resolved to ask Council for \$60,000 for the purpose, to be expended in accordance with Superintendent's recommendation, as follows: 1,200 tons of 12 and 10 inch pipe, \$43,200; 50 tons of specials, \$2,500; 4,000 pounds of brass tubing, \$1,200; 16,250 pounds of brass castings, \$4,062. Say, including contingencies, \$60,000. Council has not yet granted the appropriation asked."

NEW YORK CITY.—See our Proposals for reference to gate-houses on the New Croton Aqueduct.

ALBANY, GEO.—Water company here; capital stock of the Albany Water-Works Company will be from \$30,000 to \$50,000.

WEST DE PERE, WIS.—It has been decided to award the contract for boring an artesian well for water-works in West De Pere to Gray Bros., of Milwaukee. They offer to do the work for \$1.80 per foot, furnishing everything themselves, including the piping, etc.

GRAND RAPIDS, MICH.—We here give estimates of Consulting Engineer J. D. Cook's report to the City Council on better water-supply, which we have previously referred to:

Estimate 1—Briggs' farm reservoirs and pump-station, pumping-machinery, mains, settling reservoirs, etc., engineering and superintendence, \$328,500.

Estimate 2—Cost of low-service pumping-machinery at Briggs' farm, two 5,000,000-gallons low-service high-duty engines, with necessary appurtenances, including boilers, \$76,600.

Estimate 3—Cost of pumping-machinery for supplying the entire city from present sta-

tion, increasing capacity of present machinery to 10,000,000 per 24 hours, 5,000,000 high-duty pumping-engine, including boilers, etc., and superintendence, \$85,000.

Estimate No. 4—Stand-pipe construction, \$25,000.

Estimate No. 5—Revised distribution, including 275,480 feet of new pipe laid, special castings, Wyckoff log pipes, new hydrants, etc., \$330,000.

The summary of the plans in brief is as follows: No. 1, including the Briggs' farm pumping-station for supplying low-service district using present engine and plant for high service, including pipe distribution as per estimate No. 5, and stand-pipe as per estimate No. 4, total completed, \$775,100.

No. 2, Briggs' farm station as per estimate No. 1, pumping-machinery as per estimate No. 3, and pipe distribution as per estimates Nos. 4 and 5, total, \$768,500.

No. 3, Briggs' farm station, using present pumping-machinery for high and low service, 10,000,000 gallons capacity annex to boiler-room, pipe distribution and stand-pipe, total, \$703,500.

No. 4, Omitting Briggs' farm station and pumping from present station as per estimate No. 3, with capacity of 15,000,000 gallons, \$85,000; pipe distribution and stand-pipe, total, \$440,000. Omitting one engine, leaving pumping capacity 10,000,000 gallons, \$375,000.

City Council, October 27, voted to hold a city election to raise \$250,000.

SING SING, N. Y.—As to reports about water-works here, noticed by us some time since, our correspondent writes: "The Legislature of 1886-7 authorized the village of Sing Sing to raise, by bonding the village, the sum of \$150,000 for the purpose of constructing water-works. The act named five estimable gentlemen as commissioners to carry out the provisions of said act. From the apparent progress made thus far it would seem, that if it be true (as we were taught in childhood days), that this earth would eventually be destroyed by fire, that then, as now, there will go up from Sing Sing a long, lasting, but unavailing howl for water, water, water!"

ALBION, MICH.—Our correspondent writes in regard to the proposed water-works: "The matter is very new; only talked of. Have had plans, etc., made and committee appointed to ascertain cost of works."

JAMESTOWN, N. Y.—Charles B. Brush, C. E., of Hoboken, N. J., has examined the water-supply at Levant for the Jamestown Water Company and will report at once.

JAMESTOWN, N. Y.—Our correspondent writes: "The water company of this city have purchased about one hundred acres of land four miles from the city, and have put down four large wells which are flowing. The company proposes to supply the city from this source."

JERSEY CITY.—A 30-inch brick sewer will be built in Ogden Street, Kearney, November 28. Martin Fink is Clerk of Board of Public Works.

LEWISTOWN, ILL.—Incorporated is the Lewistown Water Company; capital stock, \$25,000. Incorporators, Lewis W. Ross, P. J. Stanard, and others.

LAKE, ILL.—The Board of Trustees held a special meeting, October 27, to take action on the water question. The board some time ago advertised for proposals for water-pipe, and it was for the purpose of awarding the contract that the meeting was held. The contract was awarded to J. B. Nichols, of the Shickle, Harris & Howard Iron Company, of St. Louis, at \$29.74 per ton of 2,000 pounds of 24-inch pipe. The amount of pipe required is about 27,000 feet and will cost about \$95,000.

WEST SUPERIOR, WIS.—We have made several references to the proposed water-works here. The contract has gone to the Superior Water-Works Company.

STRATFORD, CONN.—Our correspondent writes: "We have no water-works and none in contemplation."

PONTIAC, MICH.—Bids for constructing water-works here will be opened December 21. The works are designed by J. D. Cook, C. E., of Toledo, O.

SAN DIEGO, CAL.—The Coronado Beach Company has entered into a contract with S. W. Howland to sink a well on the North Island. He is, according to the terms of the contract, to secure a supply of water equivalent to 2,000,000 gallons in every twenty-four hours.

The Beach Company is also closing a contract with D. Schuyler, by the terms of which the company agrees to pay him \$30,000 if, after sinking a shaft 3,000 feet, he shall strike water, gas, or oil.

LANCASTER, PA.—At the meeting of the Special Committee on Water-Works Improvements, November 1, bids were opened for laying the new water-main from the pumping-station to the reservoir, as follows: B. Malone, 75c. per lineal foot; Kitch & Smith, \$8.24 per joint of 12 feet; C. Schwebel, \$1 per lineal foot; F. Hinden, \$7.20 per joint. The contract was awarded to F. Hinden at \$7.20 per joint, to be laid under the supervision of the Superintendent of the Water-Works.

PHILADELPHIA, PA.—Councils, Sub-Committee on Water on the question of granting authority to the Holmesburg, Pa., Water Company and the Diston Water Company to erect works and lay mains in the upper portion of the Twenty-third Ward, met November 1. One ordinance under consideration authorizes the Holmesburg Water Company to build works and lay pipes to furnish water for district known as Oxford and Lower Dublin townships, and the other authorizes the Diston Company to extend its mains in the section bounded by Leverick Street, Pognessing Creek, and the Delaware River.

SYRACUSE, N. Y.—The new bids for the building of a 60-inch brick sewer were opened by Council October 31, and the contract given to Martin Sprague & Co., at \$28,070. Mr. Dillon bid \$29,948, and Patrick Ready, \$30,768.

NEWARK, N. J.—Bids for constructing new basins on the Bloomfield Avenue sewer were recently rejected, and are readvertised for by the Sewer Committee of Council. Contract for sewer, except basins, has been awarded to James Coneroy.

MALDEN, MASS.—The ordinance to raise \$15,000 for a pumping-station at Spot Pond has been vetoed by the Mayor and killed.

EAU CLAIRE, WIS.—The village of Hayward, Sawyer County, is about to build water-works to cost \$15,000 or \$20,000.

ROCHESTER, N. Y.—First ordinances have just passed city council appropriating \$4,000 to the construction of the Genesee Valley outlet sewer, and some smaller sewers.

HAYWARDS, CAL.—William Hayward and Mr. Knox are sinking wells for water-supply for the town. Machinery is wanted, and a reservoir will be built. Immediate attention is necessary.

ELYRIA, O.—Our correspondent writes: "The Elyria Gas and Water Company are building a stone dam across Black River about one-half mile above their present dam, which will make a reservoir over two miles in length and contain about 100,000,000 gallons of water. Their present capacity is about 50,000,000 gallons. With the addition of the reservoir now building it would hardly carry us through the drouth we now have."

WATER-WORKS are proposed in the following towns: Barre, Ont., Can.; Cedar Falls, Mich., plans preparing; Hendersonville, N. C., cost \$12,000; Georgetown, Ky., franchise wanted; Bristol and Goodson, Va., surveys by Howard Murphy, C. E. of Philadelphia; Fort Valley, Kan.; S. B. Burr; Green Cove Springs, Fla.; J. S. Wright; Clarksburg, W. Va.; T. M. Jackson, Consulting Engineer; Georgetown, Ky.; Trenton, Ill.; Carlyle, Ill.; Missouri Valley, Iowa, \$25,000; Norfolk, Neb., A. C. Clark, et al.; York, Neb., A. C. Clark, et al.; Clinton, Ill.

SAINT SAUVEUR, QUEBEC, CAN., wants plans for water-works submitted to the Municipal Council by December 1.

GAS AND ELECTRIC-LIGHTING.

LYONS, KAN.—An electric-light plant is to be placed in Lyons for street-lighting.

MT. VERNON, N. Y.—At a meeting October 26 of the trustees of Mt. Vernon, it was proposed to make a contract with the American Electric Manufacturing Company for a plant of fifty arc-lights to be put up within a short time for lighting the principal streets and avenues. It was also suggested that proposals be invited from different gas companies for lighting the streets with gas.

HOLMES COUNTY, O. Gas and Oil Company has just been incorporated.

ERIE, PA.—The Columbia Gas-Light and Fuel Company (natural gas), with C. N. Payne as President, and James Miller as Secretary. A new pipe-line will be laid, and the main offices will be moved to Corry, Pa.

SAN JOSE, CAL.—The contract was let October 24 by the Trustees of the Hospital for the Chronic Insane at Agnews to A. F. Nye & Co., of San Francisco, to furnish a 500-light gas-machine for \$3,000.

SAN FRANCISCO, CAL.—Address the San Francisco Gas-Light Company about new works to be built for the Lowe process.

FORT WAYNE, IND.—Ordinance to grant franchise has passed City Council for the Standard Gas, Fuel and Steam Company, to establish works in the city and to lay mains through the streets, providing they furnish gas to consumers at not more than 75 cents per 1,000 feet.

ERIE, PA., Gas Company will enlarge its plant. Work on the receiver has been begun. When complete it will have a capacity of 210,000 cubic feet, and, with the smaller one adjoining, will hold 310,000 cubic feet. Superintendent Fish, representing Deily & Fowler, who have the contract for the iron-work, says the new receiver will be completed within two months.

SOVERVILLE, TENN., wants better street-lighting.

CHICAGO.—City Electrician Barrett is ordered by the Common Council to prepare estimates for a plant for lighting by electricity a square mile on the West Side of Chicago.

LAREDO, TEX.—A company (Ex-Gov. A. C. Hunt, of Colorado) has obtained a franchise to put in electric-lights.

MACON, MO.—The Standard Gas and Electric-Light Company, of Independence, Iowa, has put in gas-works here.

AMSTERDAM, N. Y., has contracted with the Thomson-Houston Electric Company, of Boston, for 100 street-lamps.

LOCKHAVEN, PA.—Chartered is the Lockhaven Electric-Light and Power Company; capital, \$20,000.

COLLINSVILLE, ILL.—County Treasurer Joseph H. Wickliffe has made the city a proposition to put up an electric-light plant. He asks a twenty-year franchise, the city to use his lights or not as they see fit, the prices charged for lights after the plant is in working order to be regulated by the average price paid for like lights in St. Louis, Kansas City, St. Joseph, Sedalia, and Jefferson City, Mo. The matter has been laid over for one month.

JEFFERSON, IOWA.—Private enterprise is developing gas wells and plant here.

GAS AND ELECTRIC-LIGHT COMPANIES, ILLINOIS.—Incorporated is the Eureka Gas and Oil Company, at East St. Louis; capital stock, \$3,000,000; incorporators, H. T. Mudd, W. H. Swan, and W. C. Bragg. The Edwardsville Light and Power Company, of Edwardsville, Ill.; capital stock, \$10,000; incorporators, C. L. Cook, W. P. Bradshaw, E. J. Jeffres. The Consumers' Electric-Light Company, of Chicago; capital stock, \$15,000; incorporators, J. C. Schumacher, M. Wilmersdorf, A. Melges.

LISBON, N. H.—Address the Town Clerk about a proposed electric-light plant here.

PORTLAND, ME., has contracted with the Consolidated Electric-Light Company for 168 arc lights and 250 incandescent lights, at \$25,000 per annum; \$1.40 per annum for each additional arc light, and \$18 per annum for each additional incandescent light.

BATTLE CREEK, MICH.—The Battle Creek Electric-Light and Power Company have been incorporated. W. A. Foot and others.

STEAM-HEATING, BUILDINGS, ETC.

WINFIELD, KAN.—The Missouri Pacific Railway Company has purchased land adjoining this city and completed arrangements with the Board of Trade for the location of machine and repair shops for the entire system of the Denver, Memphis and Atlantic Division in Kansas, embracing about 500 miles of road. The contracts entered into call for the expenditure of \$50,000 in buildings, exclusive of machinery.

THE ENGINEERING & BUILDING RECORD

AND THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 24. } PUBLISHED EVERY SATURDAY.

NEW YORK, NOVEMBER 12, 1887.

LONDON, NOVEMBER 26, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD,
conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
98 & 92 FLEET ST., LONDON.

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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed — & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 20, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

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THE BURSTING OF THE LITTLE ROCK RESERVOIR.

THIS occurrence, which was briefly noticed in our last issue, and of which a more detailed account may be found on another page, almost excites a smile. Just two hours before the time fixed for the formal opening of the new water-works, the water-works spontaneously opened themselves on a much more extensive scale than was contemplated, and more than 10,000,000 gallons of water rushed roaring down the mountain side, leaving nearly \$10,000 worth of ruin behind them.

The contractor and owner whose work was thus suddenly swept away is reported to have said: "It was rather expensive entertainment, but it was undoubtedly the grandest sight I ever witnessed." It is to be hoped that it has ere this occurred to him that a few hundred dollars spent for the advice of a competent engineer would have made him a much richer man to-day both in pocket and prestige, to say nothing of the many lives that might have been sacrificed by his blundering had the accident occurred two hours later. Whether, however, the contractor takes this view of it or not, the citizens of Little Rock, if they wish to have a reliable water-supply and to protect their own lives and property, cannot do less than insist that the work shall not be rebuilt except upon plans that have been approved by some well-qualified engineer.

There is no evidence that the contractor intentionally slighted the work in the reservoir walls; on the contrary, their overthrow *en masse* would indicate that the masonry was good, but that either the design was faulty or the foundation defective, and it is precisely on these points that the "practical man" would be most likely to fail and that the engineer would be of most service. As to the design, it may be said that Trautwine's rules would require a breadth of base about 50 per cent. greater, and the leakage suggests defective foundation.

This accident and the fall of the water-towers at Franklin and Seneca Falls, the former of which we illustrated last week and the latter described in this issue, should serve to remind those who have to do with elevated reservoirs of any kind that if badly designed, built, or managed they are about as dangerous as dynamite and rather more certain, in the long run, to cause disaster.

We do not wish to say a word to hinder in any way the building of water-works. They are an inestimable blessing in many ways to every community fortunate enough to possess them, and it cannot be supposed that small towns can afford to build them in the style or solidity that should characterize those of larger cities, but they should at least be safe, and if contractors of the energy and enterprise displayed at Little Rock will remember the advice of Davy Crockett, and with the help of some good engineer make "sure they are right before they go ahead," this most desirable result will be accomplished.

THE NEW YORK QUARANTINE AND CHOLERA.

THE statement of Mayor Hewitt in his letter to President Cleveland, that "there is a feeling in the community that greater care and efficiency are necessary in order to protect this city and the country at large from the consequences of the landing of passengers who may have the

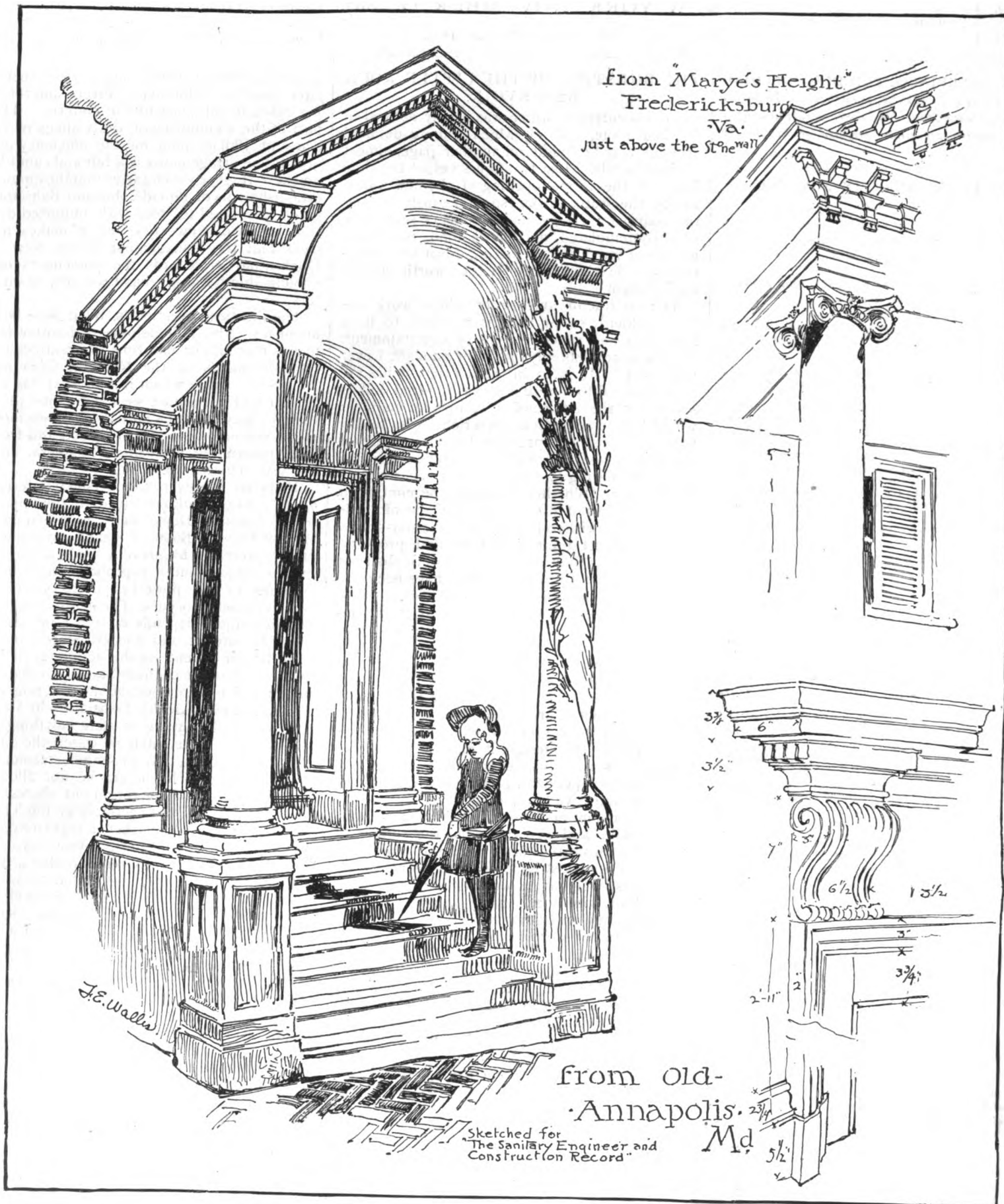
germs of disease which may be developed at a later date," is undoubtedly correct, and this feeling exists in all parts of the country. The report of the Committee of the College of Physicians of Philadelphia on the efficiency of our quarantine arrangements is a fair and candid document. It clearly recognizes that the quarantine establishments of Philadelphia and Baltimore are much less fitted to deal with imported disease than is that of New York, and it makes it very clear that the management of the New York Quarantine as regards the passengers of the cholera ship "Alesia" has been very unsatisfactory.

The practical question is, What is to be done about it? The Philadelphia committee recommends that all our maritime quarantines be put into the hands of the National Government. This is the course which this journal has always recommended, because we are satisfied that it is the only way by which both the business interests of the community can be protected and freedom from importation of small-pox, cholera, and yellow fever be secured.

Hitherto, however, the personal interests of about a dozen health officials and the opposition of the Treasury Department at Washington to the late National Board of Health have been sufficiently powerful to prevent Federal legislation on the subject, and it is probable that they will continue to be powerful until some widespread epidemic occurs. The action of Congress on this subject depends on the representatives from the interior and Western States, and, to a considerable extent, on the action taken by the health authorities of these States. Probably this matter will be discussed at the meeting of the American Public Health Association in Memphis this week. Meantime is there anything which can be done immediately to lessen the danger? Our suggestion is that passenger steamers from ports infected with cholera be not allowed to land passengers or freight on our shores. It is very possible that the Secretary of the Treasury has power to enforce such a regulation as this through the Custom-House authorities. Mayor Hewitt suggests to the President that a friendly representation made to the Italian Government might secure greater precautions in the clearance of vessels from the cholera regions. So far as the port of New York is concerned it would seem that the Governor of the State might well take some action in view of the facts brought out in the report of the Philadelphia committee. And, as has been hinted above, the health authorities of the interior States have a good deal of power to induce quarantine officials to do their duty. We hope that all these influences will be brought to bear in such a way as not only to avert the immediate and pressing danger, but to put the whole maritime quarantine of the country on a proper basis.

DESTRUCTION OF THE NEW YORK CITY HALL AND PARK.

WE have spoken with approval and admiration of the efforts of Mayor Hewitt to increase the number of parks in this city, particularly in the lower part of the city, which was laid out before the sanitary and moral necessity for breathing places in a large city was understood. We now again protest against the proposed appropriation by Mayor Hewitt and his colleagues of a large part of the City Hall Park to build-

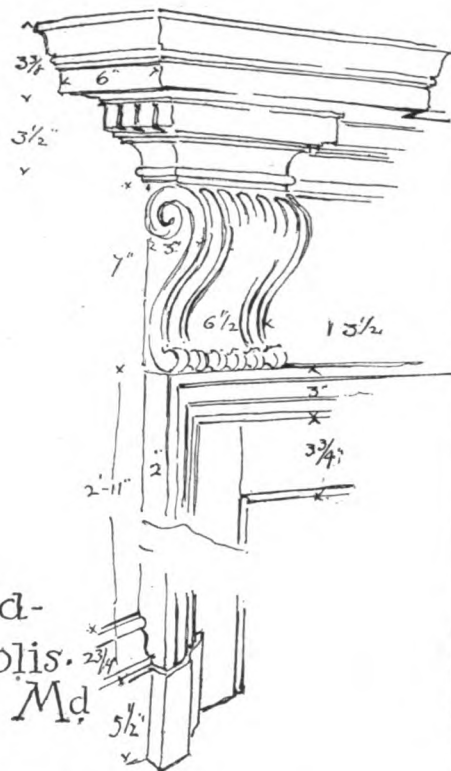


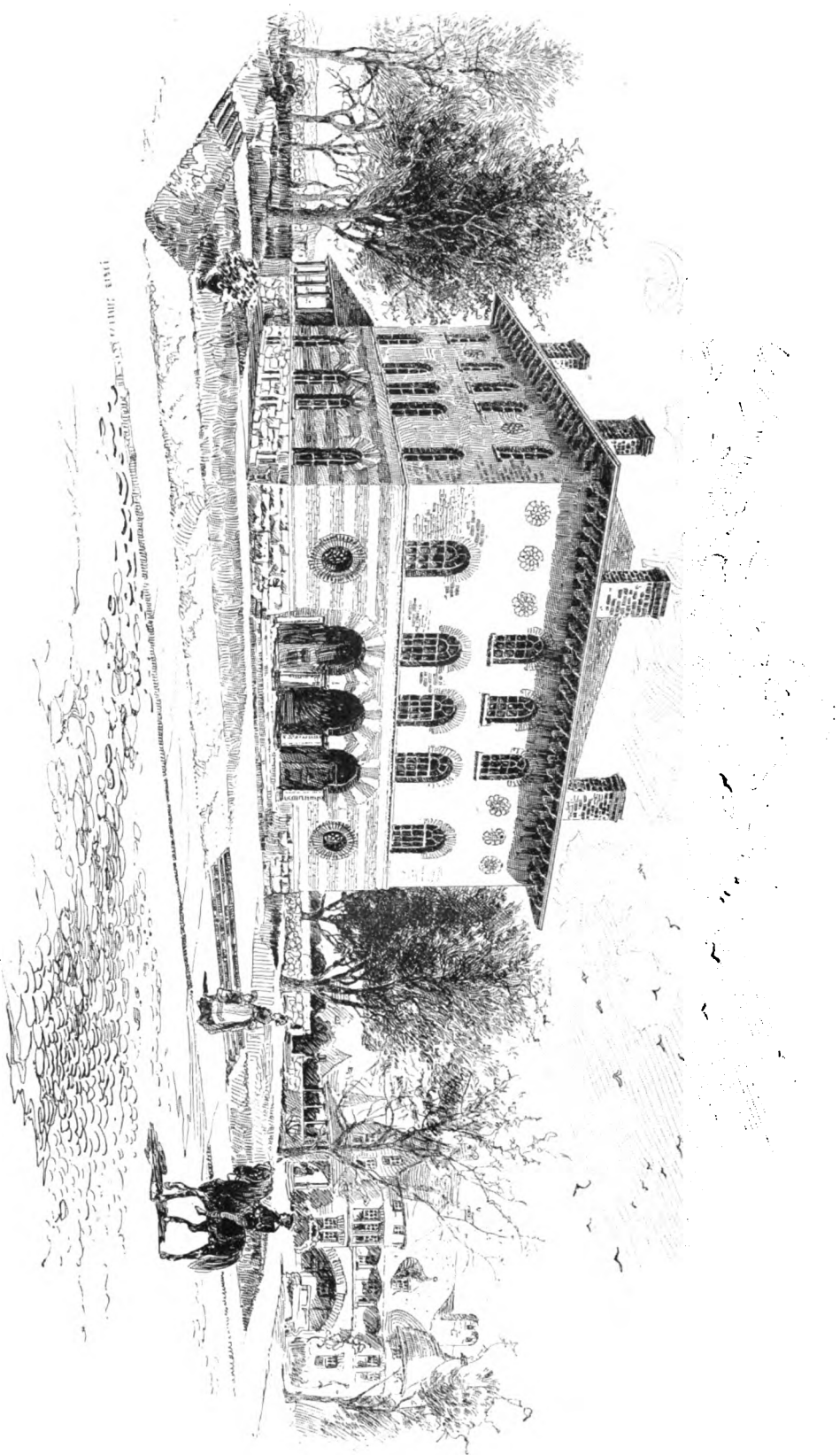
from Mary's Height
Fredericksburg
Va.
just above the stone wall

J.E. Wallis

from Old-
Annapolis, Md.

Sketched for
The Sanitary Engineer and
Construction Record





THE ENGINEERING & BUILDING RECORD ILLUSTRATED SERIES.

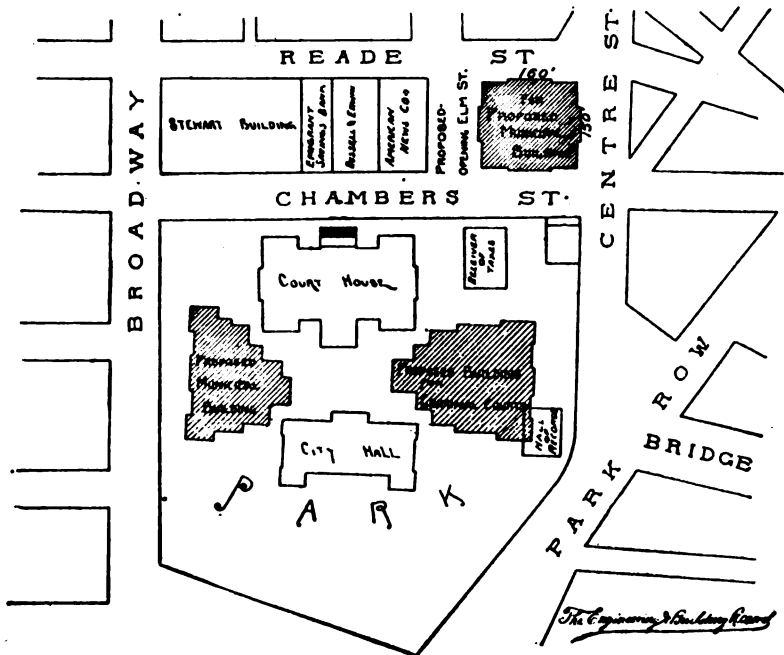
THORNWALL ORPHANAGE, CLINTON, S. C.

A. PAGE BROWN, ARCHITECT.

ing purposes, as shown in the accompanying cut. This involves not only the loss of green-sward and trees in the only park, except the Battery, below Third Street, but also the dwarfing and, architecturally speaking, killing of one of the finest specimens of classic architecture to be found anywhere, by the erection of two large "wings" to the present City Hall building.

The criminal courts should, undoubtedly, as recommended in Alderman Conkling's resolution offered on November 1, be removed to the block now occupied by the old New York and New Haven freight depot, which is owned by the city, and the demoralizing spectacle, shown daily, by the transportation of criminals through our streets, be thus abolished. The city offices which require proximity to the City Hall could be transferred to the north side of Chambers Street upon the new block formed by opening Elm Street to Chambers, and the buildings other than the City Hall and the Court House should ultimately be removed from the park.

Now, however, that plans have been asked for and some fifteen thousand dollars are to be expended for them, we trust that this scheme will progress no further than the securing of them. This expenditure and the result of the competition in securing designs, will, we hope, demonstrate to those hitherto incapable of appreciating the fact that the present architectural beauties of the City Hall will be destroyed, together with the little breathing space yet left in the park.



SUBURBAN RAPID TRANSIT RAILROAD.

THE *Yonkers Statesman* says that "great indignation exists among the people of the Twenty-third and Twenty-fourth wards at the attempt of a few owners of property on One Hundred and Twenty-ninth Street to defeat the proposed improvements" of the Suburban Rapid Transit Railroad of this city. This corporation has set a good example in honestly building a road on property that it has paid for. It therefore deserves consideration and encouragement.

Factionous and unreasonable opposition on the part of a few property-owners in dealing with a corporation disposed to act fairly is not to be commended.

The Suburban Company needs extra land for the proper conduct of its growing business, and it is willing to pay a fair price for it. It is to be hoped, therefore, that needless obstacles to its acquiring it will soon be removed.

We desire to state, for the information of our esteemed English contemporary, *Iron*, that the Japanese have not stolen a march on Western civilization by the establishment, in the Imperial University of Japan, of a chair of sanitary engineering, as such a chair was established at Columbia College, New York, in 1885.

PROPOSED NATIONAL LEGISLATION ON FOOD ADULTERATION.

THE *American Grocer* announces that a convention is to assemble in Washington on January 19 next, in which representatives from the mercantile interests are expected to co-operate with representatives from the various sanitary associations of the country to secure concerted effort to induce the next Congress to enact a law against food and drug adulteration.

Our contemporary prints a draft of the bill prepared by the committee of experts appointed by the National Board of Trade some years since, which, it will be remembered, consisted of Dr. J. S. Billings, U. S. A., Professor Charles F. Chandler, of New York, ex-Chancellor Williamson, of New Jersey, and Mr. A. H. Hardy, of Boston. The draft of the bill submitted by these gentlemen and afterwards endorsed by the National Board of Trade is the basis of the food adulteration legislation of the States of New York, New Jersey, and Massachusetts. Massachusetts and New Jersey have done some good work under it, and at the last meeting of the New Jersey State Sanitary Association resolutions were adopted endorsing the proposed convention to be held in Washington. Several attempts were made a few years since to secure national legislation on this subject, but interstate commerce questions, upon which Congress was at the time divided, prevented the passage of anything like an effective measure. It is encouraging to see the commercial interests of the country moving in this direction, and if it is proposed to enact anything like such a law as that of which the National Board of Trade secured a draft from the gentlemen we have named, they deserve the co-operation and support of our sanitary authorities. While recent investigations

have shown that there is comparatively little food adulteration in this State dangerous to health, we don't believe as much can be said for the condition of the drug market, nor that so satisfactory a state of things exists in other States where there are no checks on dishonest manufacture. Congress should certainly take measures to protect the honest merchants in one portion of the country from the unfair competition of unrestrained trickery in another.

THE ARCHÆOLOGICAL INSTITUTE OF AMERICA.

FROM the eighth annual report of the Archæological Institute of America we learn that the institute has undertaken directly the prosecution of no great work during the past year. The American School of Classical Studies at Athens being founded by the institute, the

credit of work done by members of the school may be fairly in part given to the institute.

Members of the school, aided by funds presented by the institute, have investigated the remains of the theatre at Thorikos. They have also started the exploration of the more important theatre at Sikyon, which promises rich discoveries. The foundation-walls for the school building have been completed. Under the auspices of the New York society there have been given during the past year in aid of the endowment fund of the school, a representation by students of the University of Pennsylvania of Aristophanes' "Acharnians," four lectures, by Dr. Waldstein, Professor Gildersleeve, Professor Merriam, and Professor Goodwin; and two courses of lectures by Professor Lanciani, Director of Excavations for the City and Province of Rome, all of which have been financially successful. A very successful public dinner was given at which Mr. George William Curtis presided; the principal speeches were made by Mr. James Russell Lowell and Dr. Waldstein, the newly appointed Director of the School.

THE Milwaukee Common Council have passed a bill making it compulsory for owners of theatres to put in 3-inch iron pipes connected with the city water-mains and reaching to the stage, such pipe to have a valve conveniently located and sufficient size to supply a 2½-inch hose.

ARRANGEMENT AND CONSTRUCTION OF SMALL HOSPITALS.

THE Medical Officers of Schools Association has printed a paper by Dr. Charles E. Paget on the "Arrangement and Construction of School Sanatoria," in which are given some very good plans for small hospitals of from six to thirty beds. These are intended especially for boarding schools having fifty or more pupils, and one great object kept in view is to limit the spread of such diseases as measles, scarlet fever, etc., by providing means for the prompt isolation of the first cases. Dr. Paget is the Medical Officer of Health of Westmoreland, and his remarks on the site, construction, and sanitary arrangements for such small hospitals are concise and judicious. Those who are interested in the construction of institutions of this kind will find that a shilling is well invested in the purchase of this pamphlet, which is published by J. and A. Churchill of London.

CITIZENS of Charleston and other earthquake points will be glad to learn that earthquakes may be foretold, or, at least, so Professor Milne asserted before the Japan Seismological Society, according to *Iron* of September 30. Before a shock, which was felt in Japan last January, horses pranced in their stalls half a minute before it occurred. It has also been found that pheasants scream and frogs suddenly cease croaking, while geese, pigs, and dogs give the clearest indications of an approaching quake, though the Professor omits to mention how they do it.

A DEFICIENCY OF NATURAL GAS.

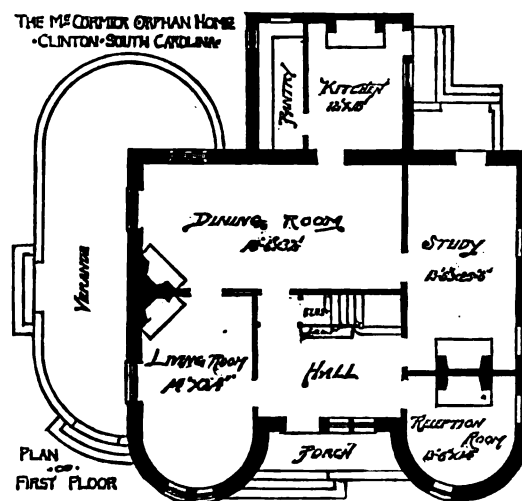
THE supply of natural gas at Wheeling, W. Va., is proving unequal to the demand, and the gas-works are in consequence being bored deeper, which it is believed will result in an increased flow.

THE State Board of Health of Ohio have published a manual for the use of boards of health, containing the State statutes relating to the public health and the decisions of the Supreme Court of the State on certain points connected with this subject. Many of the statutes were enacted years ago, but the board mildly states the case by saying that "it is not exceeding the bounds of truth to say that not sufficient attention has been given to their due enforcement."

OUR ARCHITECTURAL ILLUSTRATIONS.

THORNWALL ORPHANAGE, CLINTON, S. C.—A. PAGE BROWN, ARCHITECT.

THE subject of our vignette illustration is the Thornwall Orphanage at Clinton, S. C. It is built of local stone and brick. The second story of unstained cypress shingles; interior of oak and yellow pine; hardwood ceiling on



first floor. It is one of a group called the Thornwall Orphanage, and is in charge of Professor William P. Jacobs, D. D. It was the gift of Mrs. Cyrus H. McCormick, of Chicago.

OLD COLONIAL SKETCHES, FREDERICKSBURG AND ANNAPOLIS, MD.

(Continued from page 647.)

There are three boilers, shown at *b b b*, placed parallel in position and inclosed in a separate room, with ample space for storing all coal needed, as this shaft is convenient to transportation, being located only a short distance from railroad and Harlem River. The total capacity of these boilers is 210 horse-power. An Otis hoist is located

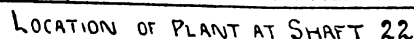


FIG. 90.

A partition extends from brick masonry inclosing the boilers to a point near door at 1, separating the engine-room from boiler-room.

The dynamo is favorably located at end of engine-room at *e*, and the air-receiving chamber of the duplex Rand compressor is better located for receiving pure air than at Shaft 22, as it is more than twenty feet from entrance *o*

The feed-pump *A* is also favorably located for safety near the boilers, and a similar location can be found in the feed-pumps at Shafts 12 to 20, except 19. The plant in Shaft 21 is not as compactly located as shown at Shaft 22, as the engineer can see only a portion of the machinery without climbing a flight of steps at *m*, which, in case of an accident to hoist or blower engine, would cause serious delay before he could give it attention, and a lazy man would neglect them. Had this plant been located ten feet further from the shaft, all the parts could have been set on the



FIG. 91.

At Shaft 13 the hoist is in one building and the boiler and engines in another. The engine and dynamos here are placed in a diagonal position from the compressor, but would have been more favorably located at the side. The Lidgerwood joist is 18 feet from head-house, and hoist 23 feet from the compressors, with about 20 feet space between the two buildings. The plant at Shaft 19 is spread out over a large area; the principal members composing this plant appear to have been arranged in the form of a parallelogram, the boilers at one end and a Dickson hoist about 38 feet from them at the other end, with only an engine on one side between them. A Rand compressor is placed on the side of this parallelogram opposite the engine and 26 feet from it and 22 feet from the boiler, which leaves a clear unoccupied space between them with an area of about 200 square feet. This useless space increases the area to be inclosed. At Shafts 16, 17, and 20 the dynamos are placed either over or under the

blowers. From South Yonkers to Harlem River the water-supply for the boilers is obtained from the Old Croton Aqueduct, but northerly from South Yonkers to a point where the New Aqueduct crosses the Saw Mill River near Shaft 12 the supply is obtained from Saw Mill River. The line of the Old Aqueduct is inclined westerly at South Yonkers to the heights bordering the Hudson River, which it continues to follow to the Croton Dam; his water-supply, therefore, is not available above the former place.

Water-tanks are stationed at Shafts 16 and 17 for the purpose of storing water, and feed-water heaters are used at Shafts 13, 17, and 19 to economize fuel by heating the water before entering boilers, which is principally accomplished by utilizing the exhaust steam.

(TO BE CONTINUED.)

BUILDING CONSTRUCTION DETAILS.

No. VIII.

(Continued from page 432.)

GRAIN-ELEVATORS.

THE huge, ungainly structures erected for the purpose of handling, storing, and distributing grain are almost unique to this country, being practically unknown in Europe, and their construction and internal dispositions are so essentially products of native genius that, as far as pure construction is concerned, hardly anything could be found which would be more typically American. In fact, such construction would be impracticable anywhere except in a country where lumber was cheap and available land very expensive, conditions which have been realized to a marked extent in the large cities of the upper Mississippi valley, the greatest wheat and corn growing country in the world. A grain-elevator is required to have a capacity for millions of bushels of grain, and yet to cover as little surface as possible; to be entirely open underneath, so as to permit of trains of cars being loaded and unloaded within the building; to be light of construction, capable of being easily, quickly, and cheaply erected, and yet of strength sufficient to stand all jars and disturbances from adjacent railroad traffic. That all these conditions have been fulfilled is due to the energy, pluck, and adaptability to circumstances which mark so many of our Western con-

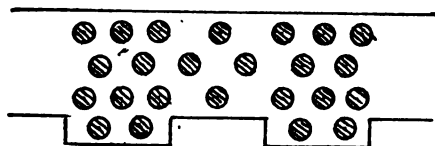


Fig. 1.
Plan of Piling.

structions. The original of the present mammoth grain-elevator, with all its complication of bins, shoots, and lifts, was doubtless the split-rail corn-crib, so familiar an object throughout the West, built with long rails or logs lapped over each other at the angles and set two or three feet above the ground. The difference between that and the elevator, with its walls of lapped plank laid flatwise and nailed together, and raised on a trestle-work of heavy timbers, is a difference of extent more than of kind.

The various large elevators throughout the country are so nearly identical in construction, that for present purposes of illustration it will suffice to consider the methods in use in Chicago, where this kind of building has attained its highest development. From necessity, most of the elevators in this city have been built on the banks of the river, where no natural foundation can be found anywhere near the surface of the ground. Piling has consequently to be employed. Fig. 1 shows the arrangement of piles under the foundations of the new Rock Island Elevator, and Fig. 2 illustrates the construction up to the ground-level. The piles are from twenty to forty feet

long, being driven down to hard pan. The butts are twelve to fourteen inches across. From observations made at the time the piles were driven, it is safely assumed that each pile will sustain a load of twenty-five tons. The maximum load on the foundations, shown by Figs. 1 and 2, is seven and three-quarters tons per square foot or about 22.15 tons to each pile. Over the piles are laid continuous rows of 4x14 sleepers extended across the entire building and above these are similar rows of 4x12 timbers. The masonry pier foundations are started upon this double-timbered

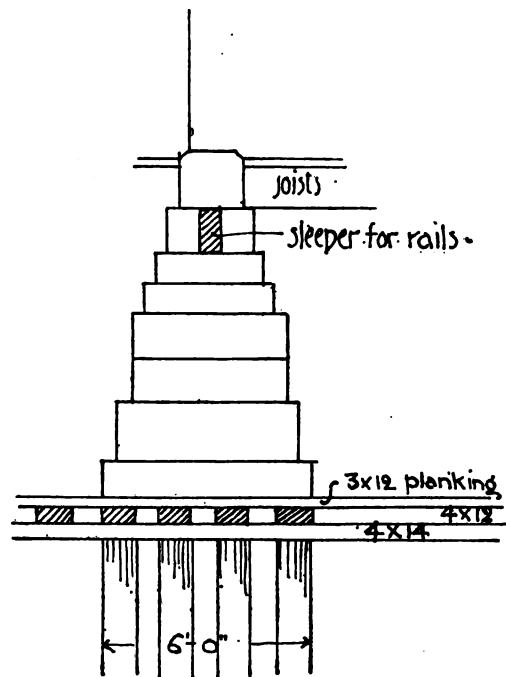
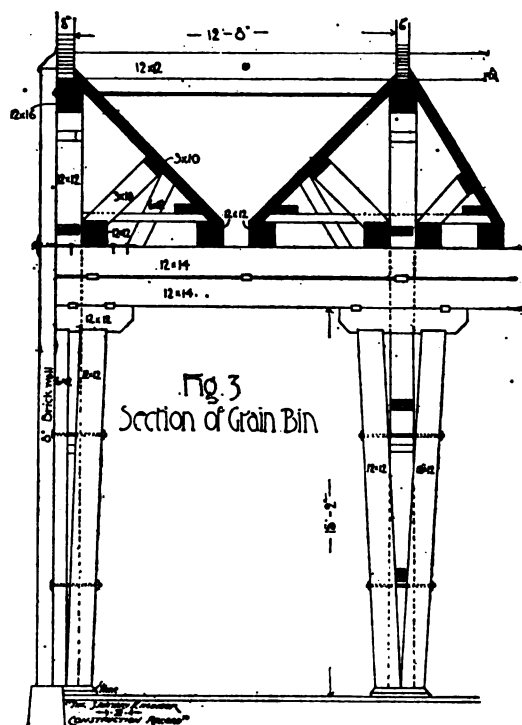


Fig. 2
Section of Foundations.

deck and the entire timber-work is covered with a closely laid floor of 3x12 plank. The masonry piers are carried up to a few inches above the street grade, where a second floor is laid over the whole area, sleepers for the railroad tracks being laid across between the piers.

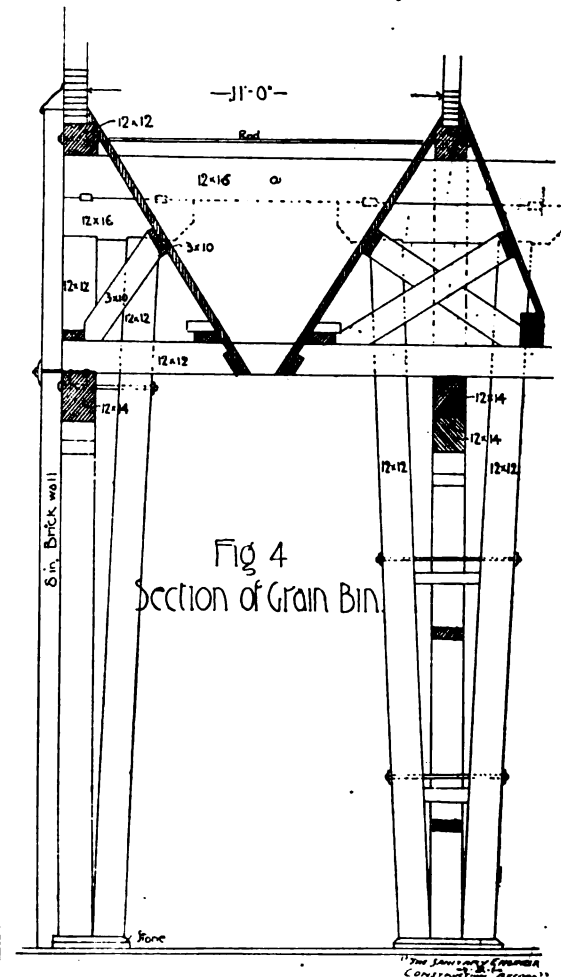
Figures 3 and 4 illustrate the superstructure of one of the L. C. Huck Brewing Company's elevators, which is practically the same as the Rock Island elevator. The



interior of the elevator on the ground-level is entirely open except for the grouped posts for the support of the bins above. The trains of loaded cars are run in on tracks between the posts and the grain shot down into the space under the floor, from where it is raised by scoops, chains, screws, or some such contrivance, to the very top of the building. Thence it is distributed into the various bins,

and finally drawn off from the bottom into other cars for reshipment.

The bins are supported on double sets of 12x12 posts, as shown by Fig. 3 and Fig. 4, two of the posts carrying the double 12x14 timbers which are extended across the building to sustain the 12x12 cross-beams directly under the bins, while the other two posts run up by the flared bin bottoms and carry the partitions. The whole upper portion of the building is divided into separate bins corresponding to the spaces between the posts below. The partitions and walls are made of two-inch planks, four to ten inches wide, laid solid one over the other, and spiked



together. As the joints of the timbers are carefully broken the whole of the bins are tied together in the firmest possible manner, additional stiffness being secured by cross and diagonal rods through the bins at different heights.

As the grain is frequently piled as high as eighty feet in the bins, it will be readily understood what a tremendous load is brought upon the posts. In the larger elevators the posts are of necessity of oak, sometimes as heavy as 16x16, and to ensure an even bearing the stone cap on which they rest is covered with a sheet of lead. The necks of the bins are closed by iron valves.

Most of the elevators in Chicago are cased in brick through the first story, and occasionally the brick-work is

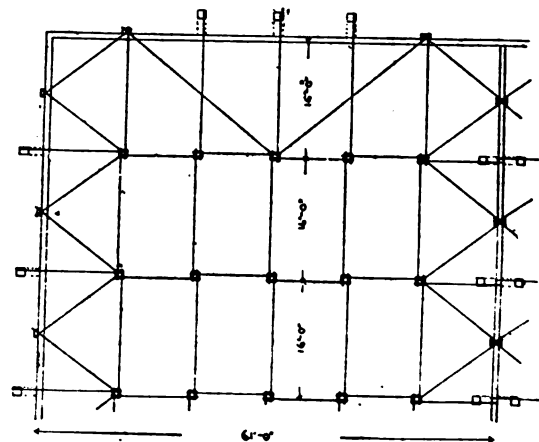


Fig. 5 Plan of a portion of Store House.

carried to the roof; but the masonry is a mere screen against fire or the weather, and the real supporting construction is in the posts. The brick walls never support anything but their own weight. Where the wooden walls are exposed it is customary to cover them with tin or gal-

vanized iron. The roofs are invariably of slate. The outward appearance of a grain-elevator is familiar to every one. The grain-bins extend as high as the first or lower roof. The central portion, rising like the clearstory story of a Latin church, is occupied entirely by the ducts, shoots, gearings, etc., used for distributing the grain to the various bins.

It is sometimes found desirable to store the grain by itself and keep the elevator-bins for transient traffic. In such a case a storehouse is built adjoining the elevator. Figure 5 shows the plan of the storehouse of the Charles Dole & Co.'s Annex D Elevator. The entire store comprises a rectangle of four times the area shown by this plan, being about 100x120, the whole divided into only three

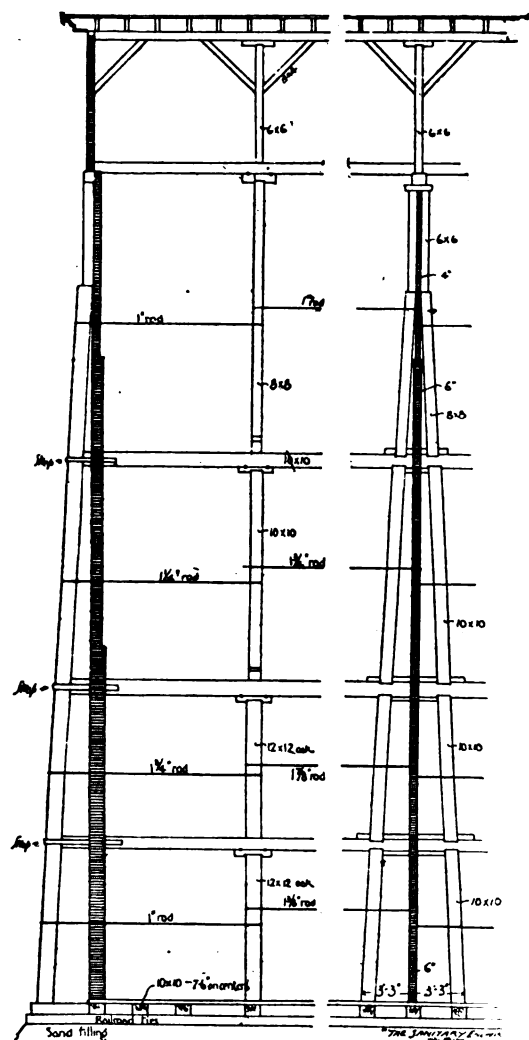


Fig. 6 Part Section of Store House

huge bins, each of which is constantly filled with grain to a depth of nearly sixty feet. Figure 7 shows a section of an exterior buttress and elevations of a line of interior posts and of the braced partition separating the bins. The storehouse was built without any foundation whatever, and the floor is hardly more than a foot above the water in the

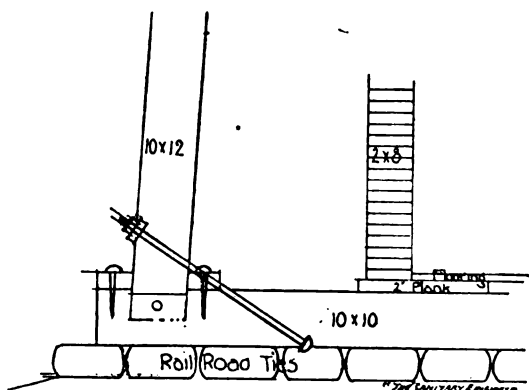


Fig. 7: Foot of an exterior Buttress

river. The ground was leveled as low as possible without striking water, all pockets and loose places in the soil carefully filled and the area covered with a thick layer of sand. On this railroad-ties were bedded, side by side, over the site to be covered by the building, and above these were laid 10x10 sleepers, about thirty inches on centres. A heavy plank floor and a matched upper flooring completed the foundation-work. The outer wall was started with 2x8

planks laid flat and nailed together. At a height of 22 feet 6 inches these were reduced to 2x6 and the upper twenty feet of wall were laid with 2x4 timbers. The interior posts ran from 12x12 oak at the bottom to 6x6 pine at the top, and besides being connected by four tiers of 10-inch cross-timbers, were tied together and to the walls by cross and diagonal iron rods varying from one inch to inch and seven-eighths diameter, arranged as shown by Fig. 5 and Fig. 6. The bin partitions were made with 2x6 and 2x4-inch timbers braced on either side with 10x10 and 8x8 struts, so that there would be no weakness in case one bin were emptied while the other remained full. And finally a gallery was carried around the storehouse inside, near the top, not shown on the drawings, and the walls and roof were covered with tin. The building has settled considerably in the centre, apparently as much as sixteen inches, but it is so firmly tied together in all its parts that the settlement has not affected it in the least for storage purposes.

All of the buildings above referred to were erected from the plans of Messrs. Baumann & Lotz, architects, of Chicago, to whom the writer is indebted for the drawings as well as for professional courtesies during personal investigations.

ON THE MANUFACTURE OF HYDRAULIC CEMENT FROM BLAST-FURNACE SLAG.*

In a paper entitled, "Hydraulic Cement from Cleveland Slag," published in the "Proceedings of the Cleveland Institution of Civil Engineers," No. 4, Session 1886-87, page 93 *et seq.*, Mr. J. E. Stead calls attention to two methods which have been applied to attain this object. One of these consists in taking 70 per cent. of slag sand, produced by Wood's process, and grinding it with 15 per cent. lime and 15 per cent. oxide of iron. The grinding is generally done wet, and the product requires to be used within a few hours of being made. Mr. Stead publishes an analysis of such a "cement," which shows: Lime, 22.90; silica, 21.61; alumina, 19.85; ferric oxide, 8.80; ferrous oxide, 4.00; magnesia, 4.36; water, 12.00. The rest of the analysis, which it is not necessary to quote in full, gives the usual non-essential ingredients. Of this so-called cement it may be remarked that it is, in point of fact, both by analysis and mode of manufacture, a mortar; and a very similar body might be produced by grinding burnt ballast, lime, and oxide of iron together. Nearly the whole of the lime present is there as free lime, and in no sort of really intimate combination with the silica and alumina. It is hardly necessary to say that such a manufacture would only interest ironmasters to the extent that they could use the product in repairs and building operations on their own premises.

The second process described is of greater interest, for it at least gives a product capable of being packed and sent into the market for sale. Briefly, it consists in grinding 75 per cent. of dry slag sand with 25 per cent. of dry-slacked lime, according to Mr. Larsen's patent. Great stress is laid upon the necessity of the most intimate mixture and minute pulverization of the ingredients, and a special machine, called by the patentee a "homogenizer," is used for the purpose. An analysis given on page 129 shows: Lime, 39.68; carbonate of lime, 4.07 = 41.96 total lime; silica, 24.34; alumina, 18.74; ferric oxide, 0.14; ferrous oxide, 0.27; magnesia, 6.59; water, 4.70. The rest of the analysis shows the usual non-essential ingredients and the two oxides of iron here mentioned may be classed in the same category. They are here merely quoted in order to make this analysis comparable with that given of the mortar made by the wet process.

The substance thus produced is shown by Mr. Stead to possess many very valuable properties, and he gives very full details of the various tests to which it has been submitted, and which it appears to have borne in a very satisfactory manner. In the discussion which followed the paper, the slag cement had, as might be expected, to bear comparison with the celebrated "Portland," a cement manufactured on a most gigantic scale from chalk and clay ground together wet, dried and burnt to incipient fusion, and finally ground for use. The general feeling of the meeting was that the test of time was the one thing requisite, and while Mr. Casebourne stated that he found that slag cement could, after three months' exposure, be scraped off with a knife, another gentleman considered that about ten years were necessary before a true judgment could be arrived at.

I am not concerned in this paper to dispute the necessity for a very long period for a fair judgment to be arrived at

* By R. J. Friswell, F. C. S., F. I. C., etc., in the *Engineer*.

in such a matter; for I consider that there are *prima facie* grounds for deferring a decision, and these are the very different chemical composition, as shown by analysis; and constitution, as shown by mode of production, of the two articles. Portland cement should consist of: Lime, 60; silica, 23; alumina, 8; the remaining 9 per cent. consisting of various non-essential ingredients. As a matter of fact, the above proportions are very closely adhered to by manufacturers, as shown by the analysis of the finished product. The substances above should be heated together in intimate mixture to a temperature approaching the melting point of cast iron. After this process scarcely any lime should exist as free lime.

Now, it is only necessary to tabulate the lime, alumina, and silica in either the dry or wet process cements described by Mr. Stead, together with "Portland," in order to show that there is a great difference in composition. For this purpose I have selected two Portlands varying very considerably:

	Portland 1.	Portland 2.	Wet Slag.	Larsen's Dry Slag.
Lime.....	59.90	55.57	22.90	41.96
Silica.....	24.07	22.92	21.61	24.34
Alumina ..	6.92	8.00	19.85	18.74

It will be seen that in the wet slag cement the lime is only about half that in the Portland poorest in lime, and even in Larsen's it is only four-fifths; the silica is about the same in all, while the alumina is nearly three times as much in the two slag compounds as in the true Portland. These differences are sufficiently large to attract attention, and though no one will pretend to say that a hydraulic cement cannot be made with such low proportions of lime, yet it must be admitted that the valuable properties which have made "Portland" a household word in every country under the sun are only exhibited by cements showing over 50 parts of lime to about 30 parts of silica and alumina. When we come to the constitution of the cement differences quite as important present themselves. In both the wet slag and dry slag processes only a portion of the lime, and that much the smaller, is in actual combination with the silica and alumina, by far the greater part—about three-fourths—is there as free lime. In Portland there should be little or no free lime, and, as a matter of fact, the semi-fusion of the mass insures this.

While Mr. Stead has thus dealt with two processes, both of them capable of yielding valuable products, there is yet a third which he has not noticed, capable of giving a more valuable cement than either. This is Ransome's process, which consists in an exact following of the Portland methods, save that slag is used instead of clay. Slag, sand, and chalk are ground together wet, and subsequently burnt to a true "clinker." The proportion of chalk used is in weight approximately equal to that of the slag, and this ensures a mixture such that, when burnt, it will closely approach in analysis the ratios of lime to silica and alumina shown by the Portland. Moreover, the burning causes that incipient fusion so requisite to secure a sound cement. On this, and kindred points, I may here quote a recent article by myself which appeared in the *Engineer* of March 4, 1887:

	Middlebrough slag.			Portland cements.	
	1	2	3	1	2
Alumina and silica.....	52.34	51.22	50.08	30.99	30.92
Lime.....	40.00	26.88	40.45	59.00	55.57

"From this it will be seen that in the slag the ratio of lime to the two other bodies is about 39.51, while in the cement it is 58.31. A simple calculation will show that on this basis the 39 + 51 = 90, or including the other bodies, 100 parts of slag requires the addition of 56 parts of lime = 100 parts of calcium carbonate—i. e., dry chalk or limestone—to give a substance yielding a good cement. The only difficulty is the hardness of the slag, but this is overcome by Mr. C. Wood's method of running it into water, when it disintegrates, and yields a slag sand, which is easily ground with the chalk after separation of a little entangled iron by sifting. Attempts have long since been made to produce this cement in the ordinary kiln, but have been abandoned, as the mixture has no coherence, and the lumps fell to pieces as soon as they got hot, and choked up the draught, putting the fire out.

"This friability, disastrous in the kiln, is no defect, but rather a virtue in the revolver, so that in this matter

the two inventions supplement each other, and the revolver thus brings a new cement material to the fore. It must, of course, be understood that slag cement cannot be made to compete with chalk-clay cement except in the neighborhood of iron-works. In the south of England the cost of carriage of the slag prevents it from being used, as clay is to be had on the spot. There is, however, every reason to believe that the slag cement may prove a profitable manufacture in the iron districts where the cement revolvers could themselves be fired by means of the blast-furnace gases, which are now everywhere being utilized as fuel.

"Careful tests of the new material have been made, from which it would appear that slag cement attains its strength more rapidly than does ordinary Portland, for it was found that Ransome's had a breaking strain of 1,440 pounds on an area of $2\frac{1}{4}$ square inches in twenty-eight days, while the Portland reached 1,325 pounds only in two years. The result is even more striking if short periods are taken, as the following shows:

Days.	Portland, $2\frac{1}{4}$ square inch area, 123 lbs. per bushel.	Ransome's slag cement, $2\frac{1}{4}$ square inch area, 129 lbs. per bushel.
	lbs.	lbs.*
2	510	740
3	608	870
7	818	1,170

* These tests were published in *Engineering* September 12, 1879.

"It is therefore evident that this process is well worth the attention of cement makers in our iron districts, while the revolver process of burning must before long come into universal use."

The method of burning mentioned as the "revolver" process is one of Mr. Ransome's inventions now attracting general attention among cement makers, and it will be sufficiently described here by the statement that it consists in heating the cement slurry crushed to a coarse powder in a revolving furnace, through which it passes in a continuous stream. The friability of the mixture of ground slag and chalk is thus an advantage, and not an objection, as is the case when kiln burning is in use.

The tests quoted were made upwards of seven years ago, and Mr. Ransome has in his possession slag cement made by his process that has been exposed on buildings for years, and yet compares favorably with Portland, and certainly cannot be scraped away with a knife. The test of time—not quite for ten years—it is true, is here offered, and the results are such as to demand the attention of ironmasters anxious to utilize a waste product. Fuller details of the "revolver" process may be seen, by any one interested, in the number of the *Engineer* mentioned above.

TESTING BERLIN'S WATER-SUPPLY.

THE testing of the Berlin water-supply is described in a recent number of the *Zeitschrift für Hygiene*. The cleansing of the water is done by the two large filtering works, one at Stralaw and one at Tegel. The water daily filtered is between 62,000 and 87,000 cub. m. The hygienic investigation of the water is done by the Hygienical Institute every Tuesday. Five tests are made at the water-works, two each from Stralaw and Tegel and one from the reservoir at Charlottenburg. At Stralaw and Tegel one test is made from the unfiltered water and one from the filtered. Five other tests are made with water taken always from the same places in the city. The preliminary tests of the water are made for clearness, color, taste, and smell. The chemical tests are for sediment, chlorine, chalk, and oxidation of the water. Qualitative tests are also made for sulphur, iron, hydrosulphuric, nitrate, and ammonia. Professor Robert Koch's test for bacteria is used. Water that contains harmless bacteria is allowed to be used, when it does not contain over 300 micro-organisms per cubic centimetre.

PAVEMENTS AND STREET RAILROADS. No. XVIII.

(Continued from page 520.)

WOOD PAVEMENT IN THE METROPOLIS.*

THE DISCUSSION.

MR. E. A. COWPER agreed that if blocks were creosoted at all they should be thoroughly saturated with creosote. It had been stated that the author had not dealt with London streets where there was a very heavy traffic, but he had actually given the first cost and maintenance of the pavement in Ludgate Hill, Aldersgate Street, Leadenhall Street, Fleet Street, and Oxford Street.

Mr. G. Allan did not think that wood pavement was a material to be recommended for further extension in the

metropolis. About fifteen years ago his attention was first directed to the question when the Val de Travers asphalt was brought before him. He first had it experimented upon in Bombay, where it was used to pave the footpaths of a number of leading thoroughfares, and it was in consequence of its success that he became the founder of the Val de Travers Co., and had the material introduced for the first time in London, their first contract being for Cheapside. When that contract was being carried out, Portland cement was used for the first time on an extensive scale. Lime was proposed, but upon his recommendation Portland cement was substituted in the contract, at an increased cost to the company of £4,000. No doubt it was to the excellence of that concrete foundation that the success of the asphalt was due. Wood should be regarded as simply a temporary material for paving; so perishable an article should not be thought of for a moment for permanent use. As granite sets had given place to wood, so wood would have to give place to an impervious material, as asphalt, or some future improvement upon it. Both frost and sunshine had a very destructive action upon wood, or any material of an absorbent nature, but asphalt had no absorbent qualities, so that whatever wet might fall upon it it was rapidly dried up by the atmosphere. The reason why the use of asphalt had not rapidly extended was owing to the inefficient arrangements of the metropolis. These had no doubt been improved of late years, but not sufficiently to justify vestries and other authorities in a further extension of asphalt. Asphalt pavement should be washed every morning as regularly as a stable or kitchen floor, and sanded if necessary, according to the state of the weather. If that were done, he believed asphalt would be everywhere demanded. In the case of wood sets there was nearly double the joint area of granite sets, and the joints were simply receptacles for dirt, mud, and horse droppings, which in dry weather were discharged in the form of dust. In asphalt there were no joints, and nothing to receive the droppings. All the dirt lay upon the surface, ready to be washed or swept away.

Mr. G. H. Stayton, in reply, said he had been glad to hear the various points discussed, particularly the criticisms of Mr. Isaacs; but he regretted the course he had taken, feeling convinced that his conclusions were wrong, especially as to cost, economy, and further extension. With regard to the question of absorption, he would only call attention to a block which had been four or five years in actual use in King's Road. It had been taken up from the centre of the road, and it showed clearly that the absorption had been practically nil. His experience had been that if the wood was sound there was no fear whatever of decay from absorption up to a certain point. He had no personal knowledge of the system of wood pavement referred to by Mr. Lawford as having been laid in 1841, neither had he ascertained the cause of its failure. The chief object of the paper was to draw attention to the modern system, as from its unprecedented extension within the last few years more advantage might be gained by a consideration of its merits than by going back a period of forty-three years. The remarks of Mr. Weaver were valuable from his great practical experience in the question, and considerable weight might be attached to his opinions thereon. It was satisfactory to note that he concurred with the author as to the advantages of the plain system, and the necessity for great care in the use of wood, but a few points demanded correction. In the first place it was to be regretted that Mr. Weaver should have fallen into the error of remarking that one of the author's statements was "that wood pavement was laid down better and cheaper in Chelsea than in any other part of London." The statements advanced in the paper did not in the least justify any such conclusion. He merely asserted that the Chelsea pavements comprised all the essentials of a sound and economical pavement, and that the result had been eminently satisfactory; but he readily admitted that the Improved Wood Pavement Company, Henson's Company, Messrs. Mowlem & Company, and Messrs. Nowell & Robson, had also carried out extremely good and creditable work. The net cost of the Chelsea pavement in Fulham Road was rightly stated to have been 10d. per square yard more than the Kensington part, but Mr. Weaver was in error in asserting that the former took forty per cent. longer time to execute. The Chelsea work had been commenced on the 5th of September, 1881, and was completed, and the road reopened, on the 15th of November, thus giving 149 square yards per diem as the result, whilst the Kensington work was carried on in two sections between the 28th of August and the 21st of October, giving 143 square yards per diem for each section. The Kensington pavement had a large proportion of old macadam in the concrete, and the system of blocking, which he considered objectionable, had been adopted; and there was little question that the cost would eventually be as great as that of the Chelsea pavement. The wood-paving works, executed in Chelsea in 1879 by the board's own staff, saved the ratepayers £3,160, which fact proved that the system might be attended with substantial advantages. Mr. Weaver's remark as to the difficulty of organizing an efficient staff was, in his experience, purely imaginary. The conclusion that when the cost of macadam exceeded 1s. 6d. per square yard per annum it was time to adopt wood, fully bore out the author's view, inasmuch as the 2s. 2d. mentioned in the first proposition included 8d. for cleansing, thus leaving 1s. 6d. for repairs only. Notwithstanding what Mr. Weaver had urged against the use of studs, the author's practical experience satisfied him that they were preferable to laths, as he had repeatedly seen considerable displacement of

blocks, and irregular width of joints, where laths had been adopted. The statements of Mr. Isaacs were fallacious and misleading. He challenged the accuracy of the author's conclusions, but failed to refute them by adducing a single reliable fact or figure as to annual cost of former or present maintenance, or records of traffic-weight, in justification of the position he had assumed. In a previous discussion in 1879, on street carriageway pavements, he also made certain statements at which Mr. Howarth expressed considerable surprise when correcting them. Mr. Isaacs must either have paid no attention to the paper and tables attached thereto, or he must have neglected to formulate statistics as to weight of traffic and cost in his district, otherwise he could scarcely have made statements which had no practical value. Mr. Isaacs contended that London traffic, in the strict sense of the term, might be seen in the Holborn district, but not in the districts of Chelsea or Kensington. To a certain extent this was correct, but subject to qualification. In Holborn itself the daily maximum traffic-weight per yard width was approximately 1,100 tons, in Brompton Road it was 648 tons, and in King's Road 603 tons. The author made due allowance for the variation in the traffic-weight in preparing the traffic table, from which it might be assumed that the annual cost of the wood-paving in Holborn, if spread over a period of fifteen years, would be 2s. per yard, besides cleansing and sanding 5d., or a total of 2s. 5d. Mr. Isaacs had made no attempt to supply figures upon this point, and without such information it could only be assumed that he had not given full attention to the subject. He had apparently intended to show that the experience of Mr. Weaver and the author was such that their opinions upon wood pavements with "London traffic" ought not to be indorsed, but he failed to adduce any serviceable information in opposition to those opinions. It might, therefore, be assumed that he had taken no pains to make himself acquainted with the statistics relating to his experience, which would certainly have been an easy matter in so small a district as Holborn, which had but fifteen miles of streets (of which three-fourths of a mile were macadamized, and 16,000 square yards were wood), whereas in Chelsea and Kensington combined there were 108 miles of streets, of which forty-one miles were macadamized, and 217,000 square yards were wood. But apart from this, the paper dealt with pavements subjected to "London traffic" in its broadest sense. Several instances were given in which the actual life of block had exceeded seven years, notwithstanding that the daily traffic-weight was upwards of 1,000 tons per yard width. Mr. Isaacs was evidently under a misapprehension as to the meaning of the item of 2s. 2d. per yard in the first proposition, as he deducted the 11d. for cleansing from 2s. 2d., instead of 2s. 10d., as explained previously, and in the foregoing reply to Mr. Weaver's remarks. The first proposition was, "That where the ascertained annual cost of maintaining and cleansing a macadamized carriageway exceeds 2s. 2d. per square yard * * * the substitution of wood is desirable." The figures (2s. 2d.) were arrived at by working out the cost of wood pavement, including first cost, interest on loans, repairs, renewals, and cleansing, for a period of fifteen years, in the following manner—viz.:

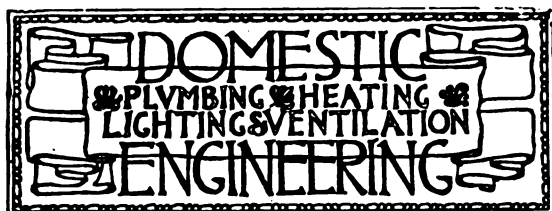
	s.	d.
First cost.....	10	6
Repairs.....	0	4
Renewals of blocks every seven years.....	12	8
Interest on loans.....	2	5
	25	11
Per annum.....	1	8½
Add cleansing and sanding.....	0	5
Total.....	2	1¾

If, therefore, the author's experience was of any practical value, he was satisfied that wood was undoubtedly a desirable and economical pavement as compared with macadam under the above-named circumstances. The observations of Mr. Rich respecting traction confirmed the statement in the paper as to the low resistance of wood pavement to traction. The author had not used the new dynamometer belonging to the Metropolitan Board of Works, but as regarded the average distance that a horse might be expected to travel without falling, Mr. W. Haywood, M. Inst. C. E., reported in 1874 that on granite it was 132 miles, on asphalt 191 miles, and on wood 446 miles, whilst the injuries to horses and obstructions to traffic were greatest on asphalt and least on wood. Mr. Matheson's remark that in many respects asphalt was better than wood coincided with the author's views which also explained why the consideration of asphalt had been excluded from the paper. Within the last month the entire carriageway of a street under the author's charge had been paved by the French Asphalt Company, this system of pavement having been adopted principally on sanitary grounds. The author did not agree with Mr. Allan that wood was likely to be superseded by asphalt, at any rate in the principal West End thoroughfares, unless the reputation of the former became damaged in consequence of their neglect, as described under the head of management. Obviously, both wood and asphalt needed constant attention in the matter of washing, cleansing, and sanding; but however suitable asphalt might be for footways, the author could only repeat, that nothing but downright neglect in the management of wood was likely to lead to its extension, on account of slipperiness and the cruelty to horses which its adoption entailed. Mr. Giles and Mr. Boulton made some remarks pertinent to creosoting. The author in no way desired to do injustice to the system, his experience of creosoted piles having been favor-

* A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings.

able; but however desirable in theory it might be to creosote wood-pavement blocks, his experience did not convince him that it was good in practice. Some few years since he had seen wood pavement taken up at Westminster, where creosoted blocks had been used. Many of the blocks were internally as rotten as touchwood, and the sappy blocks had worn down greatly under the pressure of traffic. It was difficult to see that any advantage or economy could be gained by the adoption of creosote, and the author was strongly of opinion that the surface of blocks gorged at the rate of 10 or 12 pounds per cubic foot, would become so slippery, and the jointing so unsatisfactory, that the system would create dissatisfaction.

(TO BE CONTINUED.)



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. VI.*

(Continued from page 650.)
PNEUMATIC SERVICE.

THE building is supplied throughout with a very complete pneumatic service, which was furnished and put in place by Charles Wolff, of Nos. 3 and 7 Rector Street, New York. The service is divided into three distinct systems, each working with different degrees of vacuum.

First.—The "general" system, for the exclusive use of the officers of the Equitable Life Assurance Society, whose offices are all located on the second floor. This system includes the following offices: president; first and second vice-presidents; comptrollers; cashiers; book-keepers' department; medical department; actuary's department; actuary's room; room of the President of the Mercantile Trust Company; president's private office in the tower; Mercantile Trust Company; Mercantile Safe Deposit Company; the law office of the company's counsel on sixth floor; the engineers' department; supply department; also a connection between this and the "central" system. This system is operated by the No. 5 Root blower, shown in cellar plan at J, the vacuum required being equivalent to three to four pounds.

Second.—The "central" system, which includes one line to each of the six floors above the "Equitable," or second, floor. This part of the service differs from the Equitable system in making all deliveries to a delivering station located at a convenient point on each of the various floors, instead of directly into each office. Messages are received and delivered by two hall-boys stationed on each floor for that purpose.

This system also includes a line of tubes from the kitchen—located on the top floor—to the restaurant on the ground floor; also a line to the Lawyers' Club, another to the Insurance Club; also a line to the central station. The vacuum required for this part of the system is equivalent to from four to five pounds, and is supplied by the No. 4 Root blower, marked K on cellar plan.

Third.—The "high-pressure" system, which includes a line from the central system to the U. S. Signal Service offices located on the highest point of the building, overlooking the New York Bay, with facilities for connecting with the Western Union underground system, whose pipes run directly into the building.

The vacuum for this system is furnished by a Knowles double-cylinder vacuum-pump, shown in cellar plan at L. The vacuum required for this service is seven to eight pounds.

In addition to these well-defined systems, there are a few independent lines, including one from the Western National Bank (in the building) to "central station," from there to the underground silver vaults and the offices of the Mercantile Safe Deposit Company.

METHOD OF OPERATION.

An explanation of the manner in which messages are sent by this service may not be out of place. A complete understanding of the principle upon which the carriers

containing the written messages are sent from place to place and back may be had by studying Fig. 8. Box A is one of a series at a "central station;" Box B may be located at any distant point; pipe C is connected to blower, hence there is a vacuum in both boxes, causing air to enter at D. The carriers are made of leather about six inches long, and made a loose fit for the tubes, which are of brass, and $2\frac{1}{4}$ inches diameter. It follows, if one of these carriers are dropped in the bell-mouthed tube D it will be deposited in the box B almost instantaneously. The boxes being made nearly or wholly of glass, the package is easily seen by the boy in waiting. He removes it by opening the self-closing and self-sealing door E; he examines the address of the enclosure, and quickly sends it by messenger to its destination. If there is an answer,

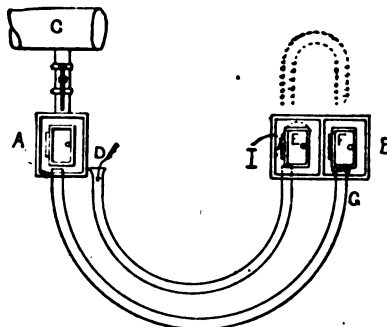


FIG. 8.

he encloses it in a carrier, opens door F, and drops it in bell-mouthed tube G, which is located in the box, and immediately it arrives at box A, from which it is withdrawn in the same fashion. It will be clear, from the above explanation, that each element, taken by itself, forms a complete circuit, and that the box B is simply a means of ingress and egress to the circuit, so that if the pipes leading to and from box B were united, as shown by dotted lines, the carrier would pass clear through the box and return to box A without assistance. The circuit is constantly kept intact or in good order by the self-closing and sealing doors in the fronts of the boxes, except at the moment of withdrawing or delivering a message. The above explanation serves to illustrate the whole, each member in the system being but a duplicate of this single element.

A central station, Fig. 9, consists of a number of boxes, A A, being placed side by side, and connected together by

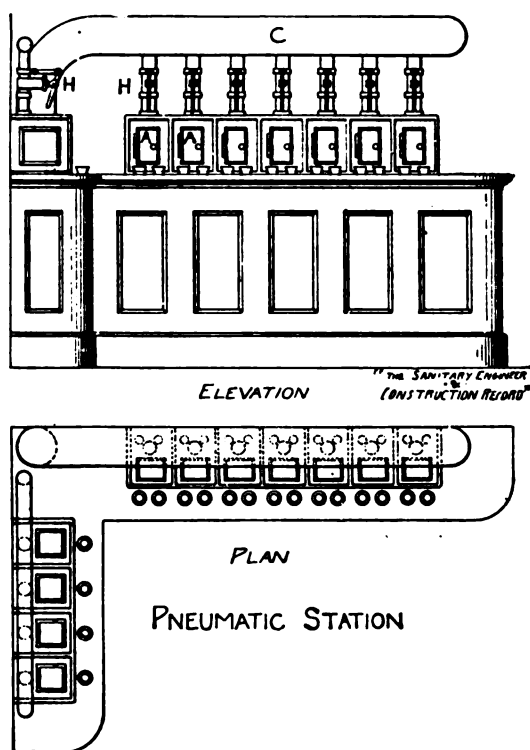


FIG. 9.

short tubes leading to an overhead main, C, that is in direct communication with the blower or vacuum-pump. Fig. 1 (basement plan) illustrates the receiving and dispatching station (central station) of the Equitable system. Its location is on the "Equitable" floor, and just over No. 84, on the cellar plan. From this point radiate valves to the various offices already named. A similar station for the central system is located on the ground floor in a booth off the grand corridor close to the grand stairway, in close proximity to the post-office boxes, Western Union Telegraph offices, District Messenger service, express, railroad, steamship, and theatre ticket offices,

This plant of pneumatic service was put in the building to do away with the usual speaking-tubes, telephoning between offices in the same building, the calling of messenger-boys to carry telegrams, and their consequent running through the building, and to secure privacy, exactness, and dispatch in transmission to be maintained, as every important office is reached by the direct service on the Equitable floor, and in the remainder of the building by means of the hall-boys stationed on each floor for the special purpose of receiving and delivering the messages. It is the largest and most complete of any plant yet erected and has features that are new, among which may be mentioned the building up of central stations by uniting a series of single boxes as shown in Fig. 9, instead of using a large single box into which all the receiving tubes gathered as heretofore.

The advantages are that boxes can be added as the system is extended further than originally intended; also, in case a door in one of the boxes is hard to open on account of the vacuum behind it, then all that is necessary to relieve it is to shut off the quick-closing gate-valve H in the pipe connection between the box and the main, thus "cutting out" that single box without disturbing the others in the circuit.

Another feature applied here that has not been used before is that of carrying an independent vacuum-pipe to a distant part of the building which lies out of the regular route of the tubes. This arrangement makes that particular box a receiving, delivering, and central station all in one, and enables private correspondence being kept up between the two points without passing through the "central" station.

The first 20 feet of tubing leading from blower No. 5 is 16 inches diameter, of No. 4 is 14 inches diameter. The rest of each main is 10 inches diameter, the object being to form a small reservoir near the blower.

The size of the main pipe used for the high-pressure service is 4 inches diameter. The pipes are regular wrought-iron pipe, the 16 and 14 inch pieces being made of galvanized spiral pipe.

The tubes are put out of sight as much as possible, and where they enter the offices they are covered over with a small closet of neat design, on top of which are set the receiving and dispatching boxes.

Figure 10 illustrates one of these boxes set on its mounting. The sides of the boxes are made of solid brass of open-frame pattern polished on the outside. Glass is used as much as possible in the construction. The small doors are hung on hinges furnished with spiral springs to keep

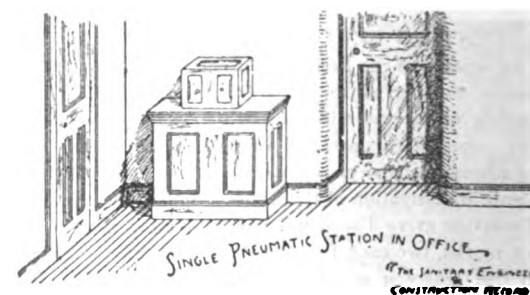


FIG. 10.

them always closed. The joints of the doors are a very neat fit and cushioned with soft rubber. Within each box is a curved guide of grate pattern to guide the carriers to fall where wanted. The method of joining the tubes to the boxes is by inserting their ends into short pieces of tube brazed into the bottom of each box, and whose inside diameter equals the outside diameter of the regular tubes. Beeswax is used in making the joint. The bell-mouth is fitted in the same manner. The joints of tubes throughout the building are soft soldered. All the necessary bends in the tubes require to be of large radius to facilitate the passage of the carriers. The large tubes shown in the cellar plan leading from the blowers connect to 10-inch wrought-iron pipes that go direct to the central stations shown in Fig. 9. The parts of these pipes that are in full view are made of brass tubing.

The boxes were special, and manufactured by the Ashcroft Manufacturing Co. In connection with the pneumatic service is a system of electric wires and call-bells to give notice from the central station to the distant box that a message has been sent. An incidental benefit arising from the use of the system is the extra good ventilation in the neighborhood of the central stations, as the amount of displacement of air by No. 4 blower running at the medium speed of 125 revolutions per minute is 97,500 cubic feet per hour, while No. 5 running at the medium speed of 100 revolutions per minute displaces 138,000 cubic feet in the same time, making a total of 235,500 cubic feet.

(TO BE CONTINUED.)

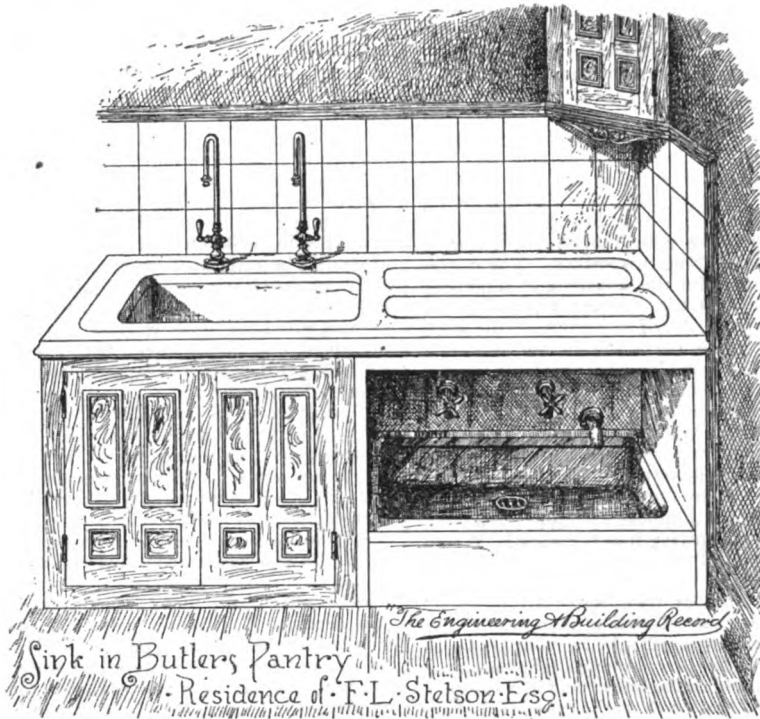
* No. I. of these articles, containing the first installment of Sketches of Plumbing, appeared in our issue of October 8; No. II., General Description of Building and Plant, October 15; No. III., Details of Pumps and Boilers, October 22; No. IV., Smoke-Stack and Passenger-Elevator Water-Supply, October 29; No. V., The Elevators, November 5.

PLUMBING IN A MADISON AVENUE RESIDENCE.

THE illustrations represent the plumbing work recently completed in Mr. Francis Lynde Stetson's residence at 576 Madison Avenue, New York. The building is a four-story brownstone structure, which is now being remodeled.

The old plumbing has been removed and replaced with new, complete from the sewer. The general features of the pipe system in this house are noteworthy on account of their simplicity and directness. The water-supply pipes

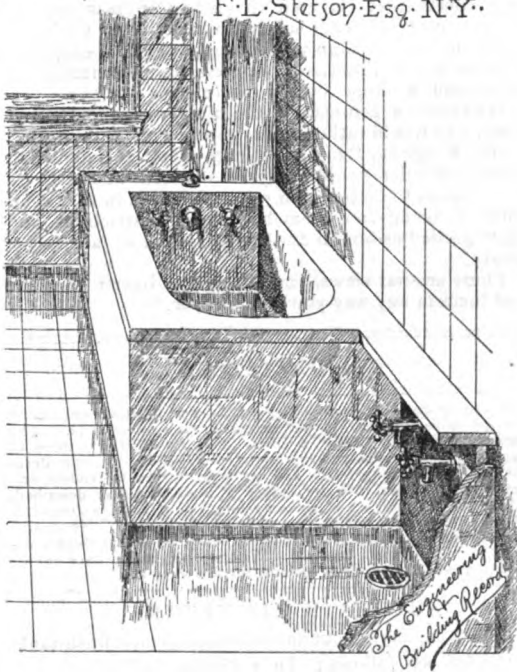
The slop-sinks shown in the butler's pantry and a floor-waste in bath-room on second floor located directly over it have porcelain-lined bottoms and marble sides, the bottom of each being set slightly depressed below the floor. The top of sink in butler's pantry is 6 inches above the floor and is all marble except the bottom, the inner dimensions being 6x16x30 inches. The top slab in front has a width of 4 inches projecting inside the sink one-half an inch. The marble slab shown over it and on butler's sink is paneled on the top and made of one piece.



run direct from kitchen to laundry suspended from the ceiling; thence with a right-angle change in course to the point shown in ceiling of laundry, where it passes through the ceiling and floor, thence in a vertical line (through the hall closets exposed in them and accessible) to a point near the roof of fourth story.

The laundry shown in the illustration is located in rear of basement hall opposite the kitchen; a butler's pantry is on parlor floor; bath-rooms on second, third, and fourth floors in the rear hall-rooms, with a water-closet in each bath-room. The wainscot in the kitchen, butler's pantry, and bath-room on second floor consists of glazed buff tile

*A Bath Room in Residence of
F.L. Stetson Esq. N.Y.*

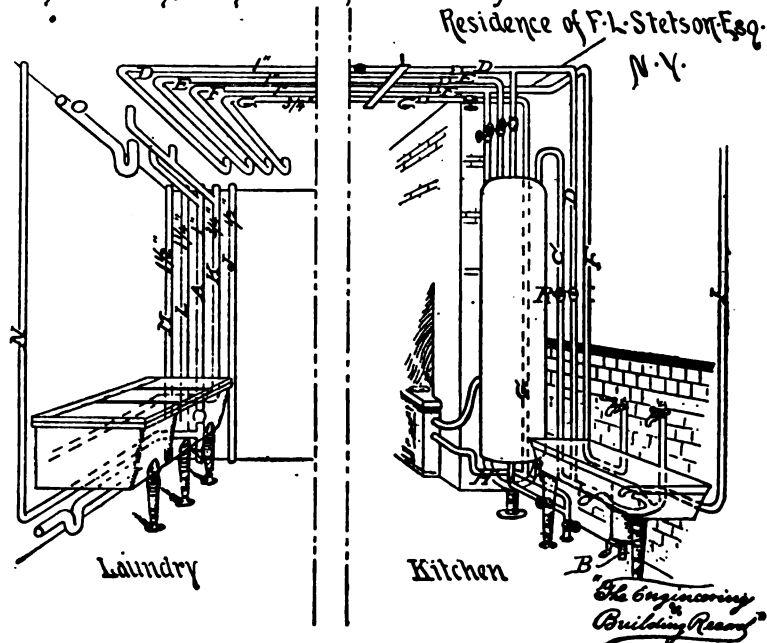


6x6 inches, with a border in butler's pantry of black walnut, and in bath-room of ornamented tile, and the latter room has a base-board of tile with similar border. The wainscot of the laundry and bath-room on third floor is black walnut and ash; and in bath-room on fourth floor the material is all ash. The bath-tub on second floor is porcelain-lined, with marble top and sides, but the water-closet seat and hip bath are trimmed with maple. The bath-tubs on third and fourth floors are planished copper.

The space over slop-sink has a width of 20½ inches and a length of 27 inches.

The nickel-plated faucets are set 18 inches above bottom of slop-sink, and the end of waste-pipe from floor-waste on second floor is shown near them. The floor-waste on second floor is at end of bath-tub, having a width of 29 inches and length of 24 inches, with bottom nearly flush

Diagram Showing Arrangement of Pipes in Laundry and Kitchen.



with the marble-tiled floor. The faucets are similar to those described on floor below. The waste from floor-waste discharges into the sink below, and then passes through waste-pipe O in laundry.

The flushing cistern for the kitchen closet is secured to wall over laundry tubs.

The cisterns for flushing closets on second and third stories are set on the floor above the closets they flush, between the bath-tubs and closet seats. The closet on fourth floor is flushed from a large tank suspended over it. This tank is 28x56 inches and 20 inches deep, which contains 123 gallons of water. The large or house tank is located in hall closet on fourth floor, and has an entrance to it from the roof. The dimensions of this tank are 3½x5 feet and a height of 7 feet, and will contain 88½ gallons. The

large tank in bath-room on fourth floor, previously described, receives its supply from the overflow of house tank only, which explains its large size, and is intended to furnish a supply for flushing whenever house tank is not kept full, but the flushing-cisterns on the floors below receive their supply from the house tank. The pipe M, shown in laundry, is the overflow-pipe from this house tank, and extends down to cellar, discharging into a sink.

The tell-tale pipe, J, also runs from house tank to the sink in cellar. A gas pumping-engine is located in the cellar; that supplies the house tank with water through the pipe L, and this supply is utilized for a high-pressure system. The low-pressure system comes direct from street supply, and extends only to the second floor, where a cut-off is located to permit the latter to be separated from high-pressure system, if desired, and would be utilized whenever the supply is cut off from the street-main.

The main supply-pipe from the street main is lead, 1¼ inches in diameter, and has two branches near the rear of the cellar—one extending up through the laundry to cut-off on second floor, and is shown at A. This pipe is continued with lead to joint shown under laundry tubs, where a branch is taken from it which extends to butler's pantry, and is indicated at N. All drinking water is supposed to be drawn from the butler's pantry, and, therefore, to obviate any objection that may be made against the use of galvanized-iron pipe for this purpose, a lead pipe is carried to this point. The other branch runs to kitchen and is connected with jacket of grease-trap, shown at B, with a branch from it under kitchen sink connecting with C, and then extends to faucet over sink, and from branch described up into top of outer boiler. The boiler is made of copper and is a double one. The pipe D branches from C and extends up connecting with centre boiler, thence running to laundry and up to house tank. The pipe E is hot supply and runs from centre boiler to laundry, thence up above house tank, with its upper end utilized as relief for excess of air-pressure of boiler. The pipe F runs from faucet over kitchen sink and thence up, connecting with outer boiler, thence to laundry and up to above house tank, and there also becomes a relief pipe. The pipe H extends from kitchen range under boiler, thence down through floor, forming a waste from boiler below the valve near floor, but branches are taken from it and extend up to outer and inner boilers. A third branch G runs up and through laundry to cut-off previously described, and is

utilized as a circulating pipe by a connection through the cut-off with pipe A, and also connecting with high-pressure system through the pipes F and D direct from house tank, but when cut-off is closed connection with high-pressure system ceases. Two check-valves are set in pipes C and D at R to prevent water from high-pressure system from extending into low-pressure system when cut-off on second floor is closed. Soft seat-metal valves are used in place of stop-cocks, above and below the boiler to control the flow. The pipe K, shown in laundry, branches from E on second floor and extends down for hot-water supply to lower slop-sink and butler's pantry. The cold supply for this slop-sink branches from A in laundry. The pipe I in kitchen extends to roof and ventilates the grease-trap. The pipes in laundry indicated by M, L, A and J have a short offset

on second floor to bring them in a vertical line with the pipes coming from boiler.

A 4-inch soil-pipe and a 2-inch vent-pipe extend from cellar to top of house, back of closet-seats at rear end of bath rooms, inclosed in a box above kitchen floor. The safe waste is inclosed with them also.

A sink is located in the cellar, which receives the discharge from all waste-pipes required by plumbing law. The tell-tale and house-tank pipes discharge here also. Mr. John Renehan, of 163 East Thirty-fifth Street, New York, was the master plumber; the work was done in accordance with plans of Mr. Charles F. Wingate, under the direction of Mr. Henry Rutgers Marshall, the architect.

THE WASHINGTON PLUMBING REGULATIONS.

THE Washington *Star* recently reports an interview with one of the Commissioners of the District of Columbia and Plumbing Inspector Robinson, as follows, on the decision of Judge Bingham on validity of certain plumbing regulations noticed in our issue of October 29:

"We thought we had the power to make those regulations," said Commissioner Wheatley to-day, referring to the decision rendered by Chief Justice Bingham, in the Court in General Term yesterday, that the District Commissioners have no power under the law to make regulations for the examination and registration of plumbers.

"We acted upon the advice of our attorney," continued the Commissioner, "who believed we had the power under the law." He considered it of great importance to the health and welfare of the community that such regulations should be made, and it was this reason that inspired our action. A man is not allowed to compound a physician's prescription or to practice medicine without a certificate or diploma, and it is quite as important that the plumbers should be competent to practice a trade or profession that is so intimately connected with the health of the people. The court very reluctantly gave that opinion," continued Mr. Wheatley: "they evidently recognized the fact that some such regulations are necessary." He stated that the commissioners will ask Congress at its next session for the power to do this.

Mr. S. A. Robinson, Inspector of Plumbing, was asked by the *Star* reporter what effect the decision of the court yesterday will have upon his department. Mr. Robinson replied that it does not change or annul the regulations as in force prior to the amendments made by the Commissioners on April 23 last. He said that even as it is the regulations which the court has declared void and illegal have accomplished much good. They have had a beneficial effect upon both the general public and the plumbers, because they have caused men to study and to look on the moral side of the business, and to give the trade an attention they had never before thought of applying to it. Books have been placed in their hands for study, which is something that was never thought of or done before the amendments were made to the regulations by the Commissioners. Mr. Robinson said that the rules caused the plumbers to take a greater interest in their business, and those who have commenced to study and improved themselves will continue the good work. "Why," said he, "I have had apprentices, as well as master plumbers, come to me and ask to be given the names of books to read upon the subject of plumbing."

"What did the trade generally think of the regulations for the examination and registration of plumbers?" asked the reporter.

Mr. Robinson replied that the majority of the plumbers were greatly in favor of their strict enforcement, and were much pleased with their practical working. They believed the regulations would have a tendency to elevate the trade in the minds of the general public, and be the means of improving the condition of business. They also were in a fair way to weed out of the business all those incompetents who bring the trade into disrepute. About ninety master plumbers have been examined, of which number only seventy passed. They are about one hundred and twenty plumbers doing business in the city.

Commissioner Webb telephoned District Attorney Riddle to-day for a certified copy of the opinion. He also asked: "Shall the Commissioners issue permits to open the streets to any bonded plumber?" Mr. Manogue replied for Mr. Riddle that the writ of mandamus did not issue, and that it would be best to refuse permits to Hannan and other unregistered plumbers until the matter is decided or until Mr. Riddle has had a chance to reply.

THE PLUMBERS' SIDE OF IT.

WHY THEY OBJECT TO THE CONTESTED REGULATIONS.

THE objections to the recent plumbing regulations on the part of certain plumbers are thus reported in the Washington *Star* of November 4:

Passing along F Street yesterday a *Star* reporter happened to meet Messrs. C. G. Thorn and E. A. Ridgway, the well-known and old-established plumbers, in conversation together.

"Well, good morning, gentlemen. I am anxious to know if you plumbers and the commissioners have settled your difficulties yet?"

"No, sir; we have not," replied Mr. Ridgway, "and I am of the opinion that the action of the Commissioners

in refusing to grant Mr. Daniel Hannan permits to open streets for the introduction of water and sewers is a great piece of injustice. Why, sir, this man is a veteran in the business. He is one of the most thorough workmen in the business. The District itself, with all its high-salaried employees, has not his equal for thoroughness in street-work. It is always done properly and with dispatch. As to his general house-plumbing, it is always carefully and intelligently performed. Yet they attempt to shut out this man and paralyze his business simply because he won't pass a certain kind of civil-service examination required by them."

"Well, if he is competent, why doesn't he comply with the new additional regulations?"

"My dear sir, it is not a question of competency with Mr. Hannan. Nobody that knows the man and his work would question that in the least. It is purely a question of principle with him. It resolves itself into this, that here is an unreasonable demand, unwarranted by common law and common sense. Why should a plumber pass an examination any more than an architect or builder? The architect is required to submit his plans of a building before he is given a permit; this plan has also the plumbing laid out on it, both being passed upon and indorsed by the building and plumbing inspectors. The matter does not end here, for if it did the houses and plumbing might be built and done entirely different from what the plans call for. There is an official inspection of the work as it progresses, made by the above officers, and it is their duty to see that everything is done in obedience to the regulations governing house building and plumbing. What does the proposed examination amount to? Nothing. It is simply an inquiry into the applicant's knowledge of how plumbing should be done as required by the rules and regulations. Is this knowledge any guarantee that the plumber will do the work as called for by the rules? Will the public health be benefited by the plumber's simply possessing this information and not applying it to the work? Would the health office set loose all the plumbers that have submitted to the examination and passed to do plumbing simply on the theory that as they 'know all about it' they will not require any supervision or inspection? As the house is planned, the house should be built (as far as safety is concerned), and as the plumbing is shown on the plans it should be executed in the house, and it is the duty of the inspectors to see that such is the case. It is here that the competency of the plumber is shown. His actual work is the best evidence of his skill. I will also add that I fully sympathize with, endorse, encourage, and will assist Mr. Hannan in his efforts to defeat these unreasonable rules."

"Then, Mr. Ridgway, you don't intend complying with the last regulations issued?"

"No, sir; I don't. If my age and experience from boyhood, my work and my dealings, are not a sufficient guarantee that I understand my business and I cannot carry it on without submitting to indignities and oppression, or the Commissioners will not allow me to carry it on, I will have no alternative but to close up. This point, however, I shall contest. They will have to show cause, and this they will be unable to do, as my record of twenty-two years, both with the old municipal government and the present one, has been of such a character that they have never had reason for charges against me."

"Mr. Thorn, what is your position in the matter?"

"Well, sir, I fully concur in and indorse the sentiments expressed by Mr. Ridgway. I will add, however, that this is not a fight between the Commissioners and Mr. Hannan alone. I have been denied permits on the same ground as Mr. Hannan—that is, my refusal to comply with the last regulations. Why, sir, these new regulations, that so much fuss has been made about, are the worst kind of bosh. There is nothing good in them. They are merely a hobby of some person or persons. Here are some things they include: 'State age, full name, residence, place of business, whether married or single, past history, experience in the plumbing trade or business, with whom he has worked.' Then an examination of the plumber as to his knowledge of physics and hygiene, the obnoxious and illegal \$3 registration fee, and letters from three disinterested, responsible citizens of the district certifying to the intelligence, good habits, and character of the applicant. Think of such men as Ridgway, Hannan, and other well-known, law-abiding, responsible citizens, being compelled to go out and ask for a certificate of character from people among whom they have lived all their lives! Neither the public nor the public health is benefited by all this nonsense. The house builders and the general public are fully protected by regulations issued in 1882. We are not opposed to nor fighting against the plumbing regulations. We have always cheerfully complied with these rules, and if there has been defective plumbing work done it is because the laws have not been rigidly enforced. The plumber doing defective work is punishable under the law by fine or imprisonment. The Commissioners have all proper redress and authority in their hands, and I am of the opinion that the courts will sustain them in punishing offenders. As Mr. Ridgway says, the plumber's work executed by him should be his passport. If the inspector sees that a workman is not competent and don't understand the principles on which the work should be done, he should have him suspended, while a plumber knowing better and yet doing bad work should be punished and either compelled to do the work properly or be driven out of the trade."

"We do not oppose legal and reasonable regulations for our business, proportionate to what is applied to other business of like kinds. There is no question now between

Mr. Daniel Hannan, Ridgway, or myself, and the plumbing inspector, his assistant, or the health officer. They know that we have always cheerfully co-operated with them and have done our work intelligently and without any annoyance to them. *We are all bonded and registered, and have been since 1882*, as the regulations then required. Why, sir, the old regulations are all right. There was no need of tacking on to them the last foolish amendments. The Commissioners have partly seen their error since the suit in court, as you will notice on reading Captain Symon's report."

"As another objectionable feature, we don't like the composition of this examining board. They are very nice gentlemen personally, but we protest against their sitting in judgment on old and experienced practical plumbers. In fact, we object and are opposed to the whole plan of crediting a kind of professional monopoly in the plumbing business. Why, sir, it would be quite possible for these examiners—I don't say they would do so—to limit the number of plumbers to a choice few."

"We think," said Mr. Ridgway, "that any citizen having the capital and enterprise should be free to engage in plumbing as in other business, and that his lack of special training should not keep him out of it, provided, of course, he employs competent workmen and abides by the rules governing house-plumbing. I may add that the largest plumbing houses in this city to-day are carried on by men who have never worked a day or served any apprenticeship at the business, but it is to be presumed, of course, that they have competent foremen and workmen to attend to the details."

"Considerable is said, I know, about the importance to the public of plumbers' work, not only in houses, but also in excavating the streets for the introduction of water and sewer pipes. The Commissioners, of course, should not grant excavation permits to every irresponsible person that might apply; but certainly this civil service examination is not necessary for such work. The fact is that a deposit of \$10 is required of every plumber, in addition to his other burdens, before he can disturb a pavement, and the cost of relaying the pavement is charged up against that deposit. As to water-mains and sewers, the plumber simply lays the lateral pipes. The District government has always tapped the sewers and water-mains. If there has been any bad work and leakage at those points its own employees, not ours, have been to blame."

"Then, sir," said Mr. Thorn, "articles have been published giving the idea that those who protest against the new regulations are men who would be properly driven out of the trade by their enforcement, and, therefore, are not worthy of attention. Well, here are three of us who protest—Daniel Hannan, whose record goes back to 1857, Ridgway's to 1865, and my own to 1866, irrespective of our time of apprenticeship. If we are incompetent or do bad work, it would have appeared before this, without a schoolboy examination."

"We know there are others just as indignant as we are, but who have taken the easier course of submitting to what they thought wrong rather than engage in a legal contest. As it is, we are the sufferers. Our work is suspended indefinitely."

"The Commissioners, their attorneys, and subordinates seem to be angry because they have not had their own way. They treat the order of the Court with very scant respect and talk about 'keeping up the fight.' If defeated in the courts, they threaten to go to Congress and get additions to their already large authority. Now, we do not covet a 'fight,' but simply to be relieved from exactions which we deem ill-advised, oppressive, unwarranted by existing and, we hope, by any future law."

"We come in contact all the time with the District officers, and would rather be on good terms with them," said Mr. Ridgway, "but not at such a cost as submitting to these new rules would imply. As citizens and business men, we want to be put on a par with others in this community, in being free from hampering restrictions, and being regarded as honest and capable until we act to the contrary."

"These are our views, and you are at liberty to make use of them in any way you seem proper."

Novelties.

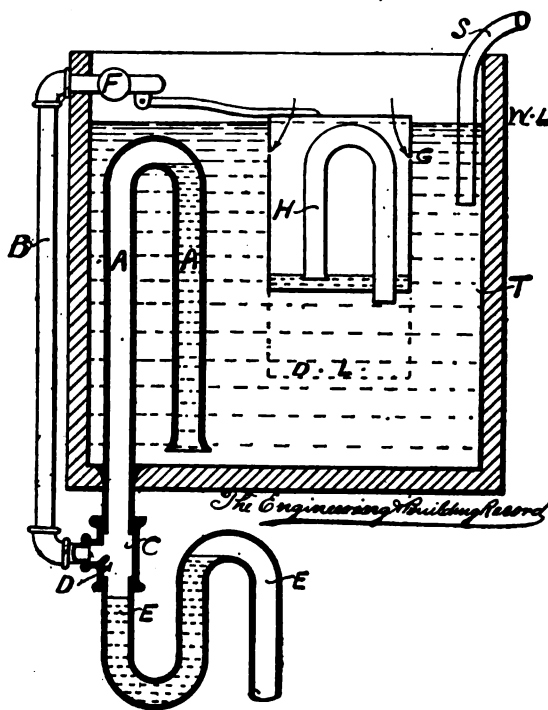
Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

AUTOMATIC FLUSH-TANK.

THE accompanying cut shows an automatic flush-tank, constructed as follows: In a cistern or tank T, is a syphon A, with which is connected a small pipe B. The connection between A and B is made by a "division tee," as known in the trade, having a small projection D. The pipe B has at its top an ordinary plumber's ball-cock F, with lever and float G. The float has inside a piece of small bent pipe H, forming a syphon, and has also openings on the top as shown by the arrows. Its shape is immaterial, as it acts like the ordinary ball-cock float. The tank is filled by a supply-pipe S, choked down to fill the

tank at any interval, from a few minutes to several hours or days. Below the syphon A is an ordinary plumber's trap E, having considerable depth of seal. The tank operates as follows:

Supposing the tank to be empty, the float G will fall to a position indicated by the dotted lines D L, and the ball-cock F will be open. Of course, as water runs into the tank, the float G rises and closes the ball-cock. The trap E becomes sealed as water begins to run over the bend of the syphon A. Then the air in syphon A cannot escape and the water in the tank rises to the water-line W L before syphon A begins to operate. Then water runs into



float G through the syphon H and holes in the cover, the float sinks, the ball-cock opens, the air in the syphon escapes, and syphon becomes charged with water and empties tank T. Air entering (after the discharge of syphon A) through pipe B, prevents partial action of the syphon when the tank is filled again, and the operation goes on indefinitely; the float G having emptied itself through syphon H.

The tank is patented by Mr. David W. Brown, of 11 West One Hundred and Twenty-fifth Street, New York.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Ketchikan Gas-Light Company.	Equitable Gas-Light Company.
November 5.....	24.90	20.55	22.17	28.92	30.16	24.53	31.59

E. G. LOVE, Ph.D., Gas Examiner.

THE *Journal of Gas-Lighting, Water-Supply, and Sanitary Improvement* of October 11 contains the following description of a new process for the manufacture of steel, which is stated to combine, as far as practicable, the best features of the Bessemer and Siemens-Martin methods, and to eliminate their defects, that has lately been introduced by Mr. B. H. Thwaite, C. E., of Liverpool, and Mr. A. Stewart, of Bradford. It consists in melting the pig-metal in what is known as a "rapid" cupola, and collecting it in a receiver, from which it is run into a vertical converter, and from thence drawn off in the ladle. In its passage through the converter, the metal is subjected to the blast from the cupola-blower. As soon as the metal is collected in the ladle, the latter is raised from its trunnions and rapidly revolved. Stirrers effectually mix the metal; and the steel is then ready for molds. It will thus be seen that the process is rapid and the plant very simple. The system can be applied to existing open-hearth furnaces, in which case the special converter is placed in the centre over the furnace-roof. The metal is run from the cupola either by means of a runner or a ladle; and in its descent into the open-hearth furnace, it is subjected to annular jets of air from the cupola-blower.

THE WRECK OF THE SENECA FALLS STAND-PIPE.

As THE result of our representative's visit to Seneca Falls, we are able to present our readers with the following facts:

This water-tower was completed the 1st of July last, and from that time until its destruction, October 28, was in constant use. It stood about one mile north-east from the centre of the village.

The pumping-station, about $2\frac{1}{2}$ miles beyond, is equipped with two double-acting pumps, each having a capacity of 1,000,000 gallons per diem.

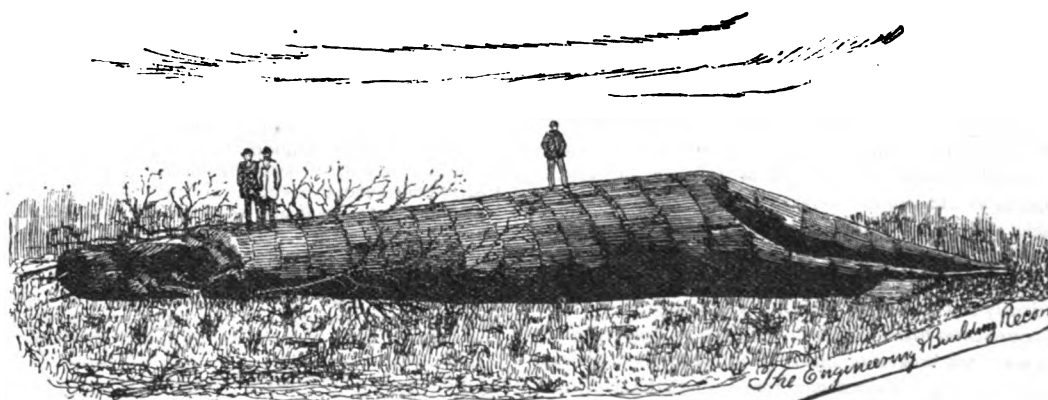
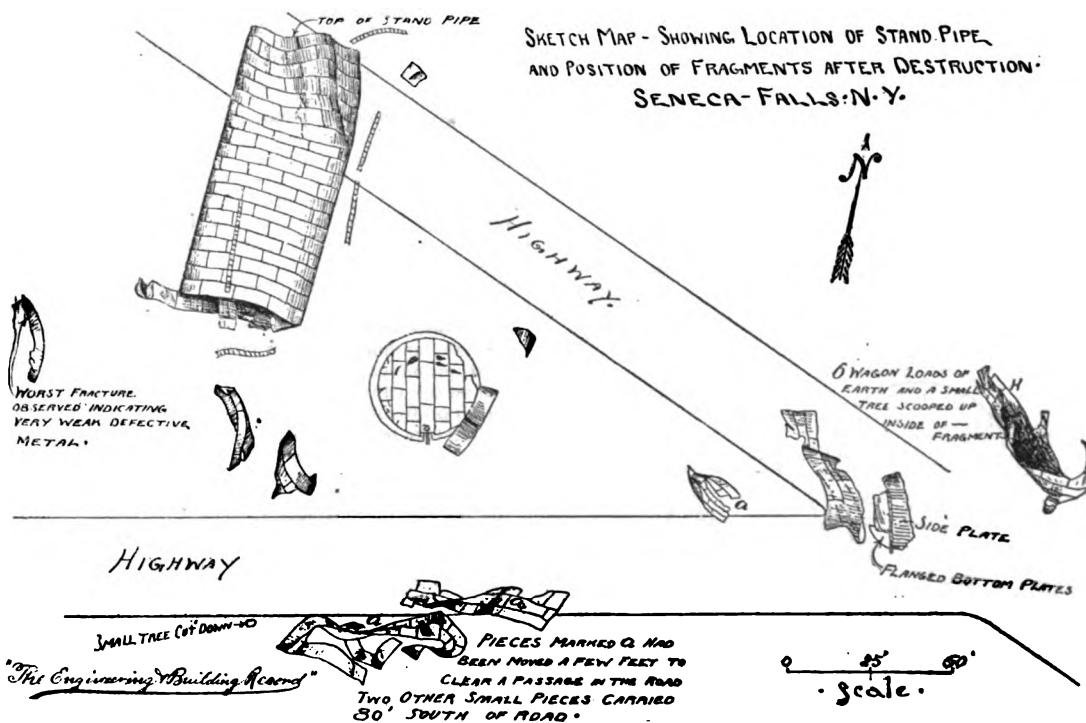
The tank, although not the highest, is said to have had, from its unusual diameter, a greater capacity than any similar one in this country—viz., 630,000 gallons. It was steel throughout and rested on a very shallow rubble foundation. A person present when it was built states that a circular pit two feet deep was dug in the stiff clay soil and the required amount of rough stone dumped in from carts; later, when the masons arrived, the heap was simply raked

over approximately level, and one course of stone laid in Rosendale cement to form the surface for bedding the bottom plates. Upon this platform the bottom plates and first four courses of the tank were riveted up, then they are asserted to have been jacked up and the surface covered three inches thick with Rosendale cement, upon which the tank was lowered. Each course consisted of ten plates 4 feet 8 inches wide, the top of each ring lapped outside the bottom of the next higher. All rivets were $\frac{3}{4}$ -inch diameter and spaced approximately $1\frac{1}{2}$ inches from the edge. All vertical seams were double riveted; the rivet lines were 3 inches apart, and the rivets were staggered and placed 3 inches C. to C. in each line. All horizontal seams were single riveted, the pitch varying from 3 inches for the heavier sheets to $2\frac{1}{4}$ inches for the lighter.

The metal weight of structure was about 270,000 pounds. The total weight sustained by the masonry when the stand-pipe was full was about 5,520,000 pounds. This gives a pressure of about 8,000 pounds per square foot on the foundation.



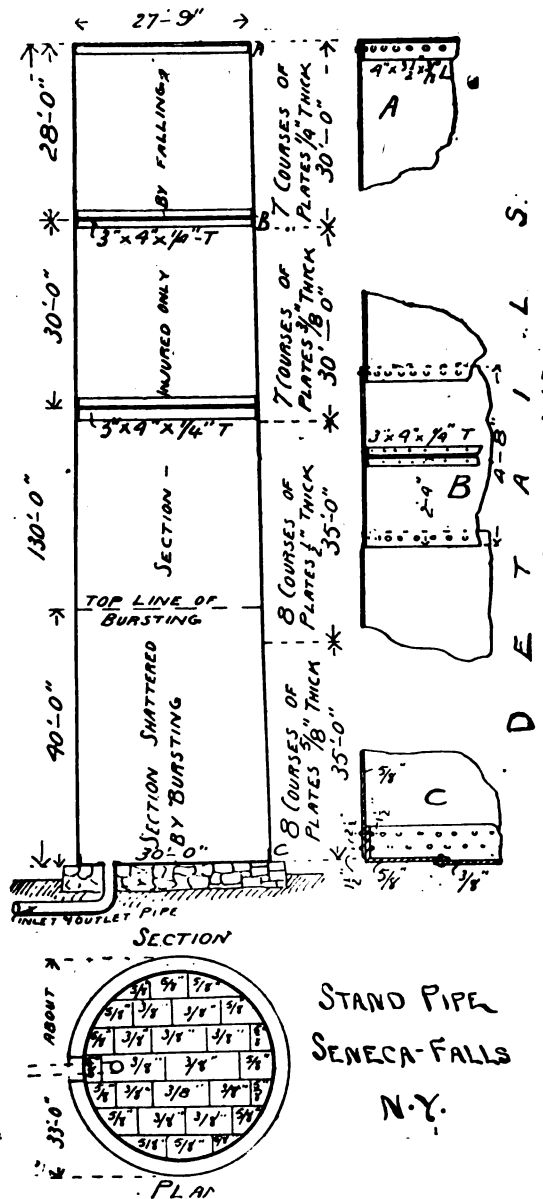
• GENERAL VIEW OF TANK AFTER ACCIDENT • SENECA FALLS • N. Y.



• VIEW OF BODY OF TANK AFTER ACCIDENT • SENECA FALLS • N. Y.

When the stand-pipe was full, the bursting pressure at the bottom was $8,000 \times 30 = 240,000$ pounds, resisted by a section of plate 12 inches high on each side. This gave a strain of 16,000 pounds per square inch of gross section, but the $\frac{1}{8}$ -inch rivet-holes at 3 inches pitch diminished the effective section so as to give a strain of 23,000 pounds per square inch of net section. The maximum shearing strain on the rivets is 25,000 per square inch. The stability against wind pressure, even when empty, was fairly good. An examination after the disaster showed that the steel plates were punched and not reamed; the metal, when tested by chisel and file, was fairly soft. The fractures indicated a coarse, poor grade of steel, in all cases very much underworked, and in some overheated, and an unusual brittleness, with great lack of uniformity. The riveting was excellent.

The foundation masonry appeared very poor and ill-laid, and, where visible through rents in the bottom plate, little or no cement, but considerable dirt, was found.



The burst shattered the lower 40 feet of the stand-pipe, hurling it in 16 principal fragments in every direction; the upper 90-foot section was carried nearly 30 feet clear of the masonry and remained in one piece, considerably flattened. Two whole sheets of the bottom plates were torn out, the disk being moved on the foundation about 5 inches north-east and cut through in five places by violent blows from corners of plates of the falling cylinder.

About three-sevenths of the flange was torn away at the angle, and it showed all round numerous open cracks from 6 inches to 30 inches long. The plates, besides being torn apart at the laps, were greatly shattered, many of them broken across the corner or through the centre, rather more of them in a vertical than horizontal direction. Cracks and gashes extended from 6 inches to 4 feet into the body of the plates from all lines of severed rivet connections. The appearance of all cracks in plates is emphatically not of tearing, but of sharp snapping.

About seven-fifths of the rivets in laps that were torn open were not broken or sheared, and most all the plates, except the flanged bottom ones, tore through the rivet lines. From the projection of the principal fragments to the east

the removal of the top section to the north-west, and the gush of the water south-west, as well as the fracture of one of the smaller fragments found west of the foundation which presented the most defective appearance of any observed, showing very poor, weak metal, it may be surmised that the break commenced on the east side in the third or fourth course or else at a vertical lap just above the flange.

A witness passing within fifty feet of the stand-pipe ten or fifteen minutes before its destruction positively states that the water was then overflowing the top. Manager A. C. Martin, who was in the pumping-house at the time, states that the pressure-gauge indicated only 70 pounds at that point, which he considered equivalent to about 100 feet height in the stand-pipe.

According to the superintendent's statement, the structure was subject to no specifications or inspection of material or workmanship, and was neither designed nor its erection superintended by an engineer.

As stated in our last issue this stand-pipe was built by contractor R. F. Hawkins, Springfield, Mass., for George H. Norman, Boston, Mass., who owns and maintains the water-works plant and receives payment from the town for its use.

SUGGESTIONS FOR A NATIONAL SOCIETY AND OTHER MATTERS.*

TO EXIST, art needs sympathy, and to grow it needs that sort of criticism which ennoble both artist and critic. Therefore, kindly intercourse among architects is useful and should be cultivated; the more because social life both spurs to effort and helps one to keep a check upon his selfishness. A man when tempted may wrong his fellow, but is less likely to when both are of the same society, in which he must endure the reproachful looks and scorn of mutual friends. Members of any organization hate to fall below its average beliefs, no matter what its practice may be.

There is growing need for better training of draughtsmen than our practice now affords, yet there is little chance but in offices for most of these boys to learn. They need schools or lectures, or both; but having neither they fall far below their own possibilities. The work of changing this state of things should be ours. Where there are no technical schools we ought at least to establish some systematic method of training, perhaps by lecturing ourselves, no matter how slight or imperfect results may at first be obtained.

Since the schedule of fees was first printed our methods of work have improved. The amount of drawing alone then done on a given job in the best office would now be regarded as shamefully superficial in the poorest. It costs, not twice, but many times the sum it used, to complete the office work of any building. We are more thorough now and should be paid in proportion.

Our efforts to throw open the Government work to the profession should continue, for the public surely has a right to the talent of its greatest architects, and the profession has a right to the work. Besides, it is a fact that public buildings badly designed depress and injure the artistic sense of the whole people, instead of inspiring to better taste as good ones would. The national structures are the landmarks of our professional horizon; they are most prominent where most men are gathered together, and no one can help but see them. So for good or ill we are all profoundly affected by them.

Statutory revision is necessary, not by Congress alone, but by the Legislatures of every State in which the practice of architecture is not already restricted to licensees possessing competent diplomas, or who have passed examinations before State boards.

But more important than anything yet attempted to be done by any society is the compiling and publishing of a code of ethics for architects, which, of course, shall show what is good, but especially what is professionally damnable in our dealings with each other. Let this be rendered in strong, clear type, and put upon the desk of every one, and it will at once have a most salutary effect upon the fee-cutting, backbiting, backstair-climbing crowd, and remove temptation from the lives of those yet uncorrupted.

As a whole the architectural societies have had plenty of time to show what they can do. But if measured by our hopes or what we have expected, their work has not been satisfactory. We have strength enough, but it has not been brought to bear at the right place and time. No one can doubt that we have tried hard, but taking the entire record we have only won that kind of success most near akin to failure. And now three courses are left to us: To give up entirely, to go on as we are, or to reorganize. The first we cannot think of, the second we are dissatisfied with, and we must look to the last for the only chance to justify continued existence. If the latter way be chosen it is plain that some if not all of the old societies must dissolve and pass away. There have been too many, and their chief faults have possibly arisen from this. Since some must go, to avoid wounded pride or vanity would it not be better for all the old societies to give up their charters and for the members to join together in a single new body where shall be centered all their social activities,

* Abstract of a paper by D. H. Burnham, F. A. I. A., read before the American Institute of Architects at their twenty-first annual convention, held in Chicago, October 20, 1887.

their art discussions and displays, their reform agitations, and finally their full authority? In this case there will be some hope for effective work on the lines of activity proper to architectural associations, and we shall have the chance to finish some of the many things we have commenced.

I do not know, in view of fresh organization, that there is to-day a single society or name to be kept, unless perhaps it be the title "American Institute of Architects," and this only because its dicta are the basis of so many court decisions in every State, and because its name and reputation are incorporated in the records of many foreign societies. This question, however, is for some future committee to deal with. The matter of naming is of little consequence compared to what the constitution and by-laws shall be. If the name of the American Institute or any other society be retained, it must not mean that their organization shall be kept as it is to-day; it must be radically different. The present condition of things is as follows: We have many societies scattered through the country, whose members have the privilege of attending the annual conventions of either one or both the national gatherings. The change should not do away with the system of local societies nor the valuable work they are capable of for the localities in which they are established; but there should be a national controlling body in general things of practice, the members to be elected from the local ones. The annual meetings of an elected body would not be mere pleasant gatherings, no man feeling any particular responsibility, but earnest meetings of those best qualified to act, each one having a sense of responsibility, a clear purpose, and the obligation upon him to do hard work.

A small body of carefully selected men meeting annually for definite purposes, and entrusted with full authority, is what is needed. It is not in the scope of this paper to particularize much about it or its dependent societies, any more than to say that the first should act in matters applying to all architects throughout the country alike, and the latter in matters of social, artistic, and local work. How the local organizations should be formed, where and when the members of the controlling body should be elected, is matter for others to consider.

There should, and undoubtedly will be, a memorial hall, where may be gathered the portraits, busts, and mementoes of our mighty dead, and in which shall be our national archives and library. The only place where this building can be erected without raising local feeling is at Washington, and there it should be.

The office of representative at Washington should be difficult of attainment, and of high honor. I believe the men should be elected for a long term, and that all elections in architectural societies, whether national or local, should be absolutely without nominations being previously made. Men ought to ballot without being prompted or checked by any committee or clique, and it should be cause for expulsion for any man to be found, directly or indirectly, soliciting office for himself, and there should be some penalty attached to his friends doing it for him. The judgment of a society is always best as to who is fitted to serve it, if the men are left to themselves.

A committee should be appointed by this meeting to act with another from the Western Association. These two should be empowered to meet and prepare a plan and recommendation to be submitted for consideration of both bodies in 1888. They should go into the matter of advisability of a complete new organization, and of how it could be brought about; of what, in the main, its form should be; how first elected; how the local bodies might come in and be used; and, finally, should give an outline of the constitution, its work, and the chances for its being successful in the direction we shall want decisive action in.

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

PROTECTING WALLS OF BATH CELLS.

NEW YORK, November 5, 1887.

SIR: Your correspondent "Tyro" requests information on some kind of paint for wooden partition walls for bath cells, and I recommend very highly Charlton Enamel Paint, an English production that I have used and had under observation for many years. Russian and Turkish bath-rooms and many hospital wards have been coated with it, and repeated washings with soap and water do not mar its color or gloss.

Yours truly,

HOWARD FLEMING.

THE ARCHITECTURAL LEAGUE OF NEW YORK.

THE Architectural League held its regular monthly meeting at Morelli's on Monday evening last, forty-five members being present.

The most important business was the election of the jury for the coming exhibition. It was decided that the jury should consist of five, three of these being non-members of the league, and all chosen from twenty-five names nominated by the Executive Committee. The jury as selected consists of Richard M. Hunt, Charles F. McKim, Augustus St. Gaudens, non-members; Clarence S. Luce, Edward H. Kendall, members.

Mr. H. O. Avery read a paper on "A Trip through the Valley of the Loire," which was supplemented by some remarks on the same subject by Mr. E. H. Kendall.

THE BURSTING OF THE LITTLE ROCK RESERVOIR.

At noon on Wednesday of last week the new water-works at Little Rock, Ark., were to have been formally opened. About two hours before that time the contractor, Colonel Zeb Ward, accompanied by his son and the watchman, were walking on the wall which divides the upper or settling reservoir from the lower or supply reservoir when Colonel Ward felt the wall giving way. He ran to the outside wall and shouted to his two companions, who barely reached a place of safety when the dividing-wall fell over bodily, liberating some 10,000,000 gallons of water, which flowed into the lower reservoir, and as that was already full, overflowed its walls and poured down the mountain-side in a torrent ten feet deep. Some men and teams were engaged in repairing the road leading to the reservoir; the men escaped, but the teams were ruthlessly tossed about and one is said to have been landed high up in a tree. The buggies of Colonel Ward and his son were swept away, and their horses took fright and have not been heard from since. It is very fortunate that the accident happened when it did, as a large crowd was expected to come out to the opening and Colonel Ward had made preparations to entertain them just below the lower reservoir and directly in the path taken by the escaping waters. The loss of life, had the accident occurred then, might have been very great. The wall that gave way was thirty-five feet high, six feet thick at the top, and twelve feet six inches at the bottom. It was built of stone laid in cement and plastered with a thick coating of the same material, and appeared to be well built, although a small leak was discovered in it the night before the accident.

Colonel Ward has determined to rebuild at once and expects to have everything all right again within six weeks. At the lowest estimate it will cost from \$6,000 to \$7,000 to repair the damage. Some citizens of the town offered to raise a subscription to assist in doing the work, but Colonel Ward declined the offer. The following letter from him will be of interest:

"To the Editor of the *Arkansas Gazette* :

"Allow me to express my heartfelt thanks to our citizens in general for their sympathy so generously extended to me in the misfortune of the loss of the centre wall to the new reservoirs to-day. This is not only a great loss to me, but to the entire city, yet it can be repaired, and while it cost me considerable money and much more hard work, I feel that I am more than paid for it all by its falling as soon as it did and before those invited to be present at 12 M. had arrived, as doubtless many would have been killed or maimed. In conclusion I will say, notwithstanding this great misfortune, the water will be given the city on to-morrow from the new works and continue for the future. Should it not prove as clear as everybody had expected, bear with it for a few months and I assure you it will all come right. Respectfully, ZEB WARD."

NEW LONDON'S WATER-SUPPLY.

From the report of the Water Commissioners of New London, Conn., for the year ending September 1, 1887, we learn that the income for the year was \$23,182, being an increase of about 7 per cent. on the previous year. The expenditures on maintenance account were \$4,087, and on extensions \$5,730. Net cost of works, \$337,308. Population, 13,000. Consumption, 1,100,000 per day.

The rainfall for the year has been heavy, amounting to 53.78 inches, and Lake Konomac, from whence the supply has been drawn, was filled. Trouble was experienced in the spring from a fishy taste in the water lasting from the 20th of May for twenty days. A report from Professor Leeds upon the subject shows that the lake covers an area of 976 acres, and was formed artificially by a dam across the outlet to a natural pond, setting the waters back over grassy land when the lake is full.

The lake or reservoir is divided into two parts by a "filter-dam," which removes a large percentage of the "peaty" color. Examinations made by gelatine peptone cultures showed also that a cubic centimetre from above the filter-dam contained 15,840 microbes, while none were found below, but this was after the bad taste had disappeared.

Professor Leeds recommends a more complete filtration by the addition of more and finer filtering material above the filter-dam, and an improvement of the banks of the lake by cleansing and embankment, so that at no time shall the water at any point be less than 5 feet in depth. A further examination is to be made whenever the bad taste reappears.

The Engineer and Superintendent, Mr. W. H. Richards, reports 40 meters in use, and recommends the substitution

of lead pipe for the cement-lined service-pipe formerly in use.

The use of the water is extending rapidly, and a special report is appended by him, showing, by comparison with other cities, the great waste going on, the supply per tap being 495 gallons and per person 91½ gallons, with but few manufactories or large users. The result is a great loss of pressure at times.

He then enters into a discussion of the various methods for detecting and preventing waste, the reclassification of water-rates, fines, etc.

He states the loss from a common sink-faucet through a ¾-inch pipe 110 feet long running free, to be under 26 pounds pressure 10,512 gallons, and under 68½ pounds pressure 17,280 gallons in 24 hours.

A NEW PAVEMENT.

OUR Milwaukee correspondent sends a newspaper clipping which says: "The North Chicago Rolling Mill Company has completed an order for fifty tons of steel rails, of a peculiar pattern, to be used in paving a block in Chicago. The rails were rolled in the Merchant Mill of the Bay View Works. They are 16 feet 10 inches in length and have a grooved surface on top, to render them rough, so that horses will not slip upon them. The rails will be placed a few inches apart, and the space between will be filled with a patent composition, which is said to be very hard and durable. The pavement is to be used where there is very heavy teaming. If the experiment proves successful it is probable that many of the Chicago business streets will be paved in a like manner."

EXCAVATION BY DYNAMITE.

We take from the *Genie Civil* of October 22 an account of the employment of dynamite for sinking holes in wet ground for foundations. It has been successfully used in building the fortifications around the city of Lyons. The foundations for the walls were to be built in an alluvial soil, constantly inundated by the River Rhone, and composed of shifting sand. It was necessary to sink two metres to find good ground on which to build. Eight cartridges of dynamite, containing each 100 grammes, were exploded together, resulting in a hole 1.10 metres diameter. In this a metal cylinder was sunk, the hole then cleared out, the concrete filled in, and the cylinder withdrawn.

Three points are especially interesting in this matter.

First—The explosion makes a hole shaped like the frustum of a cone, 1.00 to 1.20 metres in diameter, with a depth equal to 75 per cent. of that required on account of the earth falling in.

Second—The explosion compresses the surrounding earth to such a degree that the walls of the hole remain vertical long enough to clean out the hole and put in the concrete.

Third—The water is driven back so far that it does not begin to again filter through the walls for half an hour.

This operation was so expeditious that in a single day of ten hours five holes two metres deep were sunk, cleaned out, and concreted, and the work of laying foundations on them was begun. The foundation was 24 metres long.

In connection with the fatal explosion that happened recently on board a Royal Mail Company's steamer ("The Elbe"), which had just come from the hands of the engineers and was being tried on the measured mile, it may be pointed out that although the Board of Trade requires that the boilers shall be tested by hydraulic pressure to double the working strain, there is absolutely no test insisted upon for the steam-pipes. Nine men were killed by the bursting of one of the steam-pipes, between the boiler and the engine, the place of fracture occurring, not at a bend, but in a straight piece.

OUR exchanges very generally contain a description of the "Newberry-Vantim Chlorination Process" for gold and silver ores. These gentlemen, working together, seem to have adapted and simplified all previous chlorination processes, which have for so long been the hope and, at the same time, the despair of our mining engineers. Want of space does not permit a lengthy description.

ACCORDING to Mr. Graham W. Thompson, of Glasgow, the addition of 0.25 per cent. of alumina to puddled iron increases the ultimate resistance of the iron from 22 to 31 tons to the square inch. This addition also largely increases the elongation before breaking.

STAND-PIPES, WATER-TOWERS, AND THE NORMAN MEDAL.

We suggest that those who contemplate writing a paper the coming year in competition for the Norman Medal take for their subject "Stand-Pipes and Water-Towers."

A NEW oil-well explosive, called "carbonite," is, according to the *Revue Industrielle*, being largely manufactured in Germany. The composition of the explosive is not definitely known, but it has a sandy-looking, plastic appearance. It is exploded with a fulminating cartridge, and is two and one-half times as powerful as ordinary black powder. The explosive action is slow, and consequently the rock is not as badly broken up. Heat, cold, and moisture of the air have no influence on it under ordinary circumstances. The explosions leave no residue, and the gases are harmless. A cartridge of carbonite burns with a blue flame, when placed in the fire, without exploding. When struck with a hammer it explodes, after a short time, at the point struck, but the explosion is not communicated to the rest of the cartridge.

We take the following, in relation to "ozokerite," from the *Revue Industrielle*, according to a recent study made of the mineral by M. Rateau, mining engineer. In its solid form it is fusible at +62° C., and gives, when distilled, benzene, 2 to 8 per cent.; naphtha, 15 to 20 per cent.; paraffine, 36 to 50 per cent.; heavy oils, 15 to 20 per cent.; fixed residue, 10 to 20 per cent. Ozokerite is associated with petroleum; its chemical symbol is C²⁰H⁴⁰, and its elementary composition, 85.7 per cent. carbon and 14.3 per cent. hydrogen. It is soft and plastic, with fibrous breakage, and is for electrical purposes an excellent insulator. It is used for the production of paraffine and white hydrocarbons, the latter having the name of "ceresine." Ozokerite is worth from 550 to 600 francs per ton at the mine. It is only mined in large quantities in Galicia and Moldavia, although found, besides, in the Carpathian Mountains in the Caucasus, and in Utah and Arizona. The annual product is about 25,000 tons.

Iron for October 14 describes an electric whistle or trumpet devised by M. Zigang, which is designed to warn or signal vessels, trains, or tram-cars. It consists of a trumpet tube and a sounding-plate, which is vibrated by the electric current passing through an electro-magnet having its poles close to a soft iron armature carried by the plate. A regulating screw contact, with a platinum point, rests against the iron armature, and serves to interrupt the current of two Leclanche elements as the plate vibrates, thus keeping up the sound as long as desired. The apparatus is simple in construction, and can be used also as a Morse sounder in receiving telegraphic messages, the current being sent through the electro-magnet.

PERSONAL.

HENRY CLAYMEIER has been appointed factory inspector of Milwaukee in the place of Henry Siebers, resigned.

COLONEL HENRY L. ABBOTT has been ordered to proceed from New York to Newport on public business, on the completion of which he will return to his station.

D. J. WHITEMORE, Chief Engineer of the Chicago, Milwaukee, and St. Paul Railroad Company, is in Providence, R. I., where he will act with Joseph M. Wilson, of the Pennsylvania Railroad Company, and A. P. Boller, of New York, as a committee of experts to report a plan for the improvement of the railroad facilities there.

JOHN BOGART, Secretary of the American Society of Civil Engineers, was elected State Engineer of New York State, sharing in the success of the Democratic State ticket last Tuesday.

DR. MOSES GUNN, a physician and surgeon, who had been for a long time in charge of St. Joseph's Hospital in Chicago, died in that city on November 4.

MESSRS. GEORGE W. QUINTARD, Robert L. Cutting, and Thomas B. Musgrave have been appointed a Commission of Appraisal on the proposed Broadway Elevated Railroad in New York City.

CAPTAIN EUGENE GRIFFIN, Engineer Corps, U. S. A., assistant to Colonel William Ludlow, Engineer-Commissioner District of Columbia, has gone to Chicago for the purpose of investigating the underground system of electric conduits.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WANTED.

CITY OF TORONTO, ONT.

Water-Works Engineer.

NOTICE is hereby given that applications addressed to the undersigned will be received at the Water Works Office, City Hall, Toronto, Ontario, up to 12 o'clock noon, on Monday, the 28th day of November, 1887, for the position of "Chief Engineer" at the Pumping House of the Toronto Water-Works Department. Testimonials to accompany application.
JAMES B. BOUSTEAD,
Chairman Water-Works Committee.
CITY HALL, TORONTO, CANADA, November 7, 1887.

ARCHITECTURAL COMPETITIONS.

MILWAUKEE.—H. P. Schnetzky's plans for the addition to the school building on the corner of Seventh and Prairie Streets for the accommodation of the deaf mutes of the city have been accepted.

BRISTOL, TENN.—Plans and specifications for a hotel, to cost \$50,000, are asked by the Bristol Land Improvement Co.



For works for which proposals are requested see also the "Proposal Column," pages 665-669-671-672-688.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

SPRINGFIELD, ILL.—Our correspondent writes: "There was a special meeting of the City Council in regard to a new water-works system, but they did not do anything. A majority of the Aldermen objected to it, so it was decided to postpone the whole matter until the first meeting in March."

TOPEKA, KAN., proposes to develop her water-power by securing \$300,000 from the city and issuing bonds for \$200,000. The entire \$500,000 to be spent in improvements.

ADRIAN, MICH.—The question of extending the water-supply is being agitated. The Water-Works Company agrees to develop a supply of spring water of half a million gallons daily, with a storage supply of one million gallons, when the city agrees to pay a yearly rental of \$10,000 for 120 hydrants. In the meantime the city is to pay \$250 per month.

ALLEGHENY, PA.—A recent meeting of the Allegheny Water Committee Superintendent Armstrong submitted a report suggesting that a supply of water be obtained from Nine-Mile Island. The river at that point is 260 feet higher than the point from which the present supply is secured. His plan provides for the necessary machinery to pump water into the pipe, when it will flow to the city. The estimated cost is about \$750,000. George A. Cochran favored settling basins. He thought the Superintendent's plan would cost \$1,000,000. C. W. Gerwig thought a settling basin would cost \$3,000,000. He preferred a filtering plant at \$250,000. The filter could be located at Nine-Mile Island. I. R. Sefton thought action should be deferred until they had the analysis of the river water. The subject was referred to the sub-committee on machinery in connection with the Superintendent. The National Filter Company was granted permission to erect a trial plant.

PITTSBURG, PA.—North Versailles and Patton Water Companies have been incorporated.

NEWPORT, R. I.—This city has decided to expend another \$100,000 in sewers.

PIESTONE, MINN.—A special village election is to be held November 14, for the purpose of voting \$20,000 in 6 per cent. bonds to be used for putting in a complete system of water-works in this city.

FARGO, DAK.—A syndicate of Fargo capitalists has recently been organized, with Ald. McHench as President, to bore an artesian well, with the purpose of taking in gas, coal or any other valuable element to be found within 3,000 feet or so of the surface. It is believed that flowing water will be had at from 1,000 to 1,500 feet. The company is to have \$10,000 subscribed before operations are commenced, and its success is somewhat dependent upon the local option vote.

GAYLORD, MICH.—This town will vote, on November 15, on the question of putting in water-works at a cost of \$10,000.

WHITESTONE, L. I.—This town is to be supplied with water from the College Point, L. I., Water-Works. Water mains and fittings, including 20 street hydrants, will be laid at once.

JOLIET, ILL.—This city will receive bids until January 1, for a complete system of water-works. Address John D. Paige, Mayor.

WASHINGTON, D. C.—Proposals will be received by William Ludlow, Engineer Commissioner, D. C., until noon of November 21, for furnishing two 20 inch water-valves, five 12-inch water-valves, two 10-inch water-valves, sixteen 4-inch water-valves, sixteen 3-inch water-valves, and twelve 6-inch three-way-valves.

READING, PA.—The Board of Water-Commissioners are considering the question of enlarging the city's water-supply.

COLUMBUS, O.—Some additional water-mains are to be laid.

HOBOKEN, N. J.—The Pasteur Filter Co. have petitioned the Board of Freeholders for permission to have their filter tried and tested. The matter has been referred to a committee consisting of Messrs. Griffin, McDonough, and Laws.

GRAND HAVEN, MICH.—Application has been made for an injunction to restrain the city from building the public water-works.

MYSTIC, CONN.—A water-works project is on foot.

LEWISTON, ILL.—The Lewiston Water Co. has been incorporated by Lewis W. Ross, A. M. Barrett and others, with a capital stock of \$25,000.

PRINCETON, ILL.—The City Council will receive bids for sinking an artesian well, not less than 5-inch diam. Bidders to furnish their own specifications. Address Mayor or City Clerk.

PLYMOUTH, O.—The people of this place have recently voted to erect a system of water-works.

ALBANY, GEO.—The Albany Water-Works Co. will have a capital stock of \$50,000.

BELLEVILLE, ILL.—In consequence of the recent low stage of the water, the company has directed the engineer to prepare plans for a large storage reservoir and an additional supply.

MANCHESTER, ENGLAND.—Proposals will be received until Nov. 21, by the Water-Works Committee of the corporation of this city for water-meters. Address, T. H. G. Berry, Town Hall, Manchester, England.

SUPERIOR, NEB.—Water-works and electric lights will be introduced here at a joint cost of \$35,000. Address John W. Trier, Civil and Mechanical Engineer, Kansas City, Mo.

WINCHESTER, KY.—Water-works are to be erected here.

MILWAUKEE.—The Cream City Railway Co. has begun work on its Sixth and Thirteenth Ward extension. It will be about three-quarters of a mile long.

COLUMBUS, GEO.—The Board of Trade has taken up the agitation in regard to an improved sewerage system.

VICKSBURG, MISS.—A water-works tunnel 400 feet long is being constructed here.

ORLANDO, CAL.—An irrigation district is proposed. Water to be taken from Stoney Creek.

OSCODA, MICH.—Three thousand dollars has been voted for a well.

GENESEO, ILL., will increase its water-supply. About thirty additional blocks of water-mains will be laid.

MINNEAPOLIS.—City Engineer Rinker, Councilman Mills, and Supervisor Walsh will visit Cleveland, Buffalo, Brooklyn, Philadelphia and New York, to examine water-works pumps.

BAKERSFIELD, CAL.—Our correspondent writes: "A franchise from the Board of Supervisors has been granted to C. L. Kounner, of this place."

HOLRIDGE, NEB.—Plans and specifications are being prepared by A. A. Richardson, Lincoln, Nebraska, for water-works. Estimated cost, \$50,000, on which the city will grant a franchise. There will be about 24,000 feet of pipe, with 57 hydrants. Information will be furnished by addressing A. A. Richardson, the Engineer, Lincoln, Neb. The plans will be ready about Dec. 10.

GREENVILLE, S. C.—A proposition has been made by Julius H. Howard to construct a system of water-works.

KEY WEST, FLA.—A sewerage system is contemplated.

SALISBURY, MD., is to have a system of water-works. Address the Mayor.

DALLAS, TEX.—The plans of J. D. Cook, of Toledo, for a water-supply for this city have been adopted by the City Council. Two reservoirs, costing \$161,000, with a capacity of 50,000,000 gallons each, will be built.

JEFFERSONVILLE, KY.—The contract for the construction of a system of water-works for this city has been awarded to Messrs. S. R. Bullock & Co., of New York City.

HENDERSONVILLE, N. C., is to have a system of water-works costing \$12,000; also sewerage system. For further information address J. D. Davis.

PLYMOUTH, IND.—Address the City Commissioners regarding system of water-works.

HAYWARD, WIS.—Address the Commissioners in regard to a water-works system.

STAUNTON, ILL.—The Board of Village Trustees has ordered a special election, on December 15, for the purpose of raising \$6,000 for water-works.

COLUMBIA, S. C., Nov. 9.—Our correspondent writes: "We have had water-works in our city for fifty years, and are now only enlarging the system by building another reservoir of one and a half million gallons capacity, and the erection of another pump, of one and a half million gallons capacity in twelve hours. The addition is rendered necessary on account of increased demands for water-supply by different manufacturing enterprises now and being established in our city, such as cotton-seed oil mills, cotton factories, shoe and hosiery factories, ice manufactories, etc., and also by the increase in population."

CROSS ROADS, TEX.—It is reported that a water-works system is being constructed by Bryon J. Barry, of Corsicana.

COLUMBIA, S. C.—This city will build additional reservoir, costing \$12,000. Will also erect additional pumping-machinery.

GREENVILLE, TEX.—New bids will probably be called for by the City Council, for building water-works.

GAINESVILLE, TEX.—Messrs. Bell & Myers have contracted to sink an artesian well.

CENTRALIA, ILL.—This city has voted to construct water-works at once. For full information address Mayor B. Haussler.

PENSACOLA, FLA.—The Board of Health officers have appropriated \$15,000 to start the sewerage system as planned by Col. Waring, the engineer of the Memphis system.

BATON ROUGE, LA.—Mr. Miller, of Dubuque, Iowa, is in this city with a view of contracting for building water-works. The City Council will meet to consider such propositions as he may make.

BOUND BROOK, N. J.—This place is to have water-works at an estimated cost of \$20,000.

BRIDGES.

CANTON, OHIO.—The Wrought-Iron Bridge Co., of this city, has been awarded the contract for the construction of a bridge between Verona and Rome, N. Y.

EAU CLAIRE, WIS.—Our correspondent writes: "No bridges are to be built at present, except one iron bridge of two spans, each 100 feet, for which contract is let. Bonds voted to be issued were for the above and two bridges recently constructed."

POTTSVILLE, PA.—Our correspondent writes that no action has been taken towards the construction of a bridge or bridges at Washington Street.

FORT WAYNE, IND.—The County Commissioners have advertised for new proposals for building iron bridge over St. Mary's River at Spy Run Avenue.

COHOES, N. Y.—The contract for the abutments and approaches of the bridge crossing canal at Ship Street has been awarded to John Flood, of Fort Edward. Cost, \$5,781.70.

ROCHESTER, N. Y.—Rochester Bridge and Iron-Works has been awarded the contract for construction of Plymouth Avenue Lift-Bridge, to cost \$16,485. Engineers' estimate was \$16,500.

BROOKLYN, N. Y.—The bridge of the New York and Rockaway Beach Railroad across Jamaica Bay is to be reconstructed.

BEVERLY, MASS.—A petition is in circulation which is to be presented to the County Commissioners praying for a hearing on the project of constructing a bridge across the railroad. The plans contemplate a draw-bridge from Rantoul to River Streets, over the railroad at an expense of \$12,000.

DULUTH, MINN.—The Common Council is considering the proposition for erecting a bridge on Lake Avenue over the railroad crossing.

PINEVILLE, KY.—Address the Pineville Land and Iron Co. in regard to bridge to be built across the Cumberland river.

MEMPHIS, TENN.—A bridge at Monroe Street, costing \$4,000, will be built by the East End Railroad Co. and this city.

TOLEDO, O.—Address R. H. Cochran, of this city, in regard to a bridge to be built over the Ohio River at Martin's Ferry.

RALEIGH, N. C.—Address J. Allen, Chairman Bridge Commissioners in regard to several iron bridges to be built by the Commissioners of Wake Co., N. C.

SUTTERVILLE, PA.—Address W. I. Scott in regard to bridge costing \$50,000, to be constructed over the Youghiogheny at this place.

PITTSBURG, PA.—The Marshall Avenue and Lake Street Bridge, between the cities of Minneapolis and St. Paul, which is being built by the adjoining counties, and the contract for which was a short time ago awarded to the Wrought Iron Bridge Co. of Canton, O., will have a total length of 1,273 feet, made up as follows: East Approach, 19 feet; Shore Span, 95 feet; Tower, 19 feet; Braced Arch, 456 feet; Tower, 19 feet; Braced Arch, 456 feet; Tower, 19 feet; Shore Span, 133 feet; West Approach, 57 feet. Mr. J. S. Sewall is the Chief Engineer, and the work will be manufactured under the supervision of G. W. G. Ferris & Co., Inspecting Engineers, Pittsburg, Pa.

VICTORIA, B. C.—The San Francisco Bridge Co. has been awarded the contract for building a bridge over the Fraser River.

PROPOSALS.

PAVING.—Proposals will be received, until November 30, for paving certain streets. For further particulars address W. M. Owens, City Clerk, Eau Claire, Wis.

BUILDING.—Proposals will be received until December by J. C. Saunders, Arkadelphia, Ark., for building colleges.

BUILDING.—Bids are being received by J. H. B. Adams, Malvern, Ark., for erecting a building, to cost \$35,000.

MASONRY-WORK.—Proposals will be received for grading, trestling, and masonry work of about 100 miles of the Chattanooga, Rome, and Columbus Railroad by J. W. English, President Chattanooga Brick Co., Atlanta, Geo.

BUILDING.—Proposals will be received, until December 15, by W. H. Baldinger, Galveston, Tex., for building Sealy Hospital.

WAXAHACHIE, TEX.—Proposals will be received until November 18 for the construction of six iron bridges by the Commissioners' Court. For further particulars address B. F. Hawkins.

GRADING.—Address R. L. Gorham, President Board Public Works, St. Paul, Minn., until November 17, in regard to grading certain streets.

SEWER.—Proposals will be received until November 17, for constructing a sewer, together with the necessary catch-basins and manholes. For further particulars address R. L. Gorham, President Board Public Works, St. Paul, Minn.

BUILDING.—Proposals will be received until December 5, for the excavation, masonry, and brick-work for one double set of officers' quarters at Fort Clark, Tex. For further particulars address Major A. J. McGonnigle, Chief Quartermaster, U. S. A., San Antonio, Tex.

SIDEWALKS.—Proposals will be received, until November 15, by William Carlyle, Chairman Com. on Works, Toronto, Can., for the construction of sidewalks in various streets.

SAND.—Address the Department of Public Works, 31 Chambers Street, New York City, until April 18, in regard to furnishing 1,200 cubic yards of Cow Bay sand for road surfacing, and also repairing sidewalks.

MISCELLANEOUS.

VICKSBURG, MISS.—Rittenhouse Moore, contractor for dredging in the river here, will begin work in a few days. The work is in charge of Captain William J. Rossell, U. S. A.

TRADE CATALOGUES.

The Chadwick Lead-Works, of Boston, Mass., have sent us their catalogue for 1887. The catalogue illustrates and describes the various sizes and weights of lead pipe and sheet lead manufactured by the firm. In addition, there are also a number of diagrams showing the calibre and outside diameter of the various sizes of lead tubing for various purposes. Also several valuable tables given.

PUBLICATIONS RECEIVED.

REPORT OF THE OPERATIONS of the Sanitary Department of the City of Glasgow for the five years ending May 31, 1887. Peter Fyfe, Sanitary Inspector.

REPORT OF THE COMMITTEE ON DRAINAGE and Water-Supply to the Executive Committee of the Citizens' Association of Chicago, Ill.

REPORT OF THE COMMITTEE ON THEATRES and Public Halls to the Citizens' Association of Chicago.

ANNUAL REPORT OF THE CITIZENS' ASSOCIATION of Chicago, October, 1887.

RULES AND REGULATIONS Governing the Construction of Sewers, Drains, and Plumbing-Work for the City of Amsterdam, N. Y., adopted by the Sewer Commissioners October 11, 1887. William B. Landreth, Constructing Engineer.

RECENT ADVANCES IN ELECTRICITY, Electric-Lighting, Magnetism, Telegraphy, Telephony, etc. Edited by Henry Greer, New York Agent, College of Electrical Engineering.

MANUAL OF THE HEALTH LAWS of the State of Ohio, compiled by the State Board of Health, 1887.

FORTY-FIFTH REPORT to the Legislature of Massachusetts relating to the registry and return of births, marriages, and deaths in the Commonwealth, for the year ending December 31, 1886.

THE ARRANGEMENT AND CONSTRUCTION OF SCHOOL SANATORIA. A paper read before the "Medical Officers of Schools Association," by Charles E. Paget, L. R. C. P., M. R. C. S., London.

SEVENTH ANNUAL REPORT of the State Board of Health of New York. Transmitted to the Legislature, January 19, 1887.

THE SANITARY CODE of the Borough of Asbury Park, N. J. Adopted March 22, 1887. Rules and Regulations of the Board of Health. Henry Mitchell, M. D., President.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*b*, brown stone; *br*, brick; *br st*, brick store; *bs dwell*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

73d, s. s. 99 w Boulevard, school house and teachers' room; cost, \$40,000; o, Rutgers Presbyterian Church; a, R. H. Roberts.

Popham, s. s. 250 w Morris av, 2 fr dwells; cost, \$48,000 each; o, Jac S Carvalho; a, Charles S Clark.

9th av, n. s. 502 n 99th, 2 flats and stores; cost, \$15,000 each; o, Frank L. Fisher; a, Cleverdon & Putzel.

9th av, e. s. 504 s 62d, 2 br flats and stores; cost, \$20,000 each; o, James B Gillic; a, M V B Ferdon.

Pier 37, foot Charles, sheds; cost, \$60,000; o, Mayor, Aldermen and Council; a, R P Staats.

74th, s. s. 98 e Av A, factory; cost, \$25,000; o, John B Radley; a, Jordan & Gillic.

ALTERATIONS—NEW YORK.

17 South, store and office; cost, \$6,500; o, J M and T A Levy; b, M Dugan.

60 s s w cor W Boulevard, public bldg, stable and riding academy; cost, \$14,000; o, Bryan Lawrence; a, Cabbott, French & Co.

101-105 Greenwich, office bldg and apt; cost, \$5,000; o, Wm C Frohme; a, Wm C F; b, Geo Healy.

BROOKLYN.

48 and 50 Himrod, dw; cost, \$9,995; o, H Ringle; a, Th Engelhardt.

W s Humboldt, 50 s Scholes, storage bldg; cost, \$5,000; o, Williamsburg Brewing Co; a, J Platte.

147 Grand av, br ink factory; cost, \$11,500; o, John Underwood & Co; a, E A Sargent.

S s Withers, 275 ft of Lorimer, E D, br leather factory; cost, \$10,000; o, Richard Young; a, De Meuron & Snitt.

E s Flatbush av, 9 s Prospect pl, 2 br store and dws; cost, \$22,500 each; o, Peter J Harrison; a, Chas Conlon.

S w cor 3d av and 53d st, store and dw; cost, \$6,000; o, Jas Carroll; a, N L Spicer & Sons.

S s Meeker av, 175 e Graham av, fr dw; cost, \$6,500; o, A Feldman; a, A Bauch.

W s Lewis av, 30 s Pulaski st, double flat; cost, \$12,000; o and a, John McGarry; b, P W Higginson.

N s Myrtle av, 330 e Nostrand av, b s flat; cost, \$7,000; o, a and b, John Clark.

W s Patchen, 82 w Greene av, br bldg; cost, \$7,000; o, Jas W Smart; a, J D Reynolds.

N e cor Fulton st, Decatur st, and Tompkins av, flat; cost, \$12,000; o, Betts C Moore; a, J D Reynolds.

S s Wyckoff, 525 w Smith, workshop; cost, \$5,000; o, John Davis; a, Stephen Hazzard; b, Bruns & McCann.

221 N 8th, dye works; cost, \$20,000; o, Narwood Bros; a, J F Hunt.

E s Bushwick av, 55 s Melrose st, store and dw; cost, \$8,000; o, Wm P Wagner; a, Th Engelhardt.

ALTERATIONS—BROOKLYN.

S e cor Nostrand av and Floyd st, fr bldg; cost, \$13,500; o, Jacobi & Kelley; a, same.

N w cor Kent av and R'way, br dw; cost, \$7,000; o, Wm Hayward; a, W H Gaylor.

MISCELLANEOUS.

DETROIT.—Grand River, br st; cost, \$25,000; o, J Huff Jones; a, Mason & Rice; b, G Vivier.

72 Adams, br home; cost, \$25,000; o, Working Woman's Home Assoc; a, W G Malcomson; b, Topping & Fisher.

551 Congress, br dwell; cost, \$7,000; o, H Wunsch; a, Donaldson & Meier; b, as above.

Kirby, br school; cost, \$35,000; o, Board of Education; a, R Wallace; b, Jaynes & Son.

120 Trumbull, br dwell; cost, \$7,000; o, S Pierson; a, Spier & Rohns; b, A Hild & Co.

BALTIMORE, MD.—Chester, Chase and Biddle, stone and br factory, 320x60, 2-story, and annex, 320x48; cost, \$40,000 to \$50,000; o, Baxter Electric Manufacturing and Motor Co; a, Benj B Owens; b, B F Bennett.

PHILADELPHIA.—13th s Vine, 2 story br and stone church bldg, 55x77; b, J R Millison.

Rear 224 N 13th, 4 story br factory; b, James W Saunders & Son.

Also 50 2 story dwells.

ST. LOUIS, MO.—DeKalb and Barton, a br factory; cost, \$12,000; o, Pauly Jail Works; b, B Koesters.

JACKSONVILLE, FLA.—Bids are now being received by Mr Miller Drew for the erection of building on Ashley Street.

BUILDING INTELLIGENCE.

MINNEAPOLIS.—Logan av, bet 8th and 10th av N, fr dwell; cost, \$10,000; o, Cobb & McKen.

4th, bet Hennepin & Nicollet av, basement, fire-proof office bldg; cost, \$10,000; o, Globe Printing Co.

18th, bet 6th and 7th av S, 4 br dwells; cost, \$36,000; o, L F Menage.

Park av, near 24th st, fr dwell; cost, \$20,000; o, F W Foreman.

Park av, bet 18th and 19th st, fr dwell; cost, \$22,500; o, Webster & Hart.

Yale place, bet 14th and 15th st, fr dwell; cost, \$8,000; o, J A Page.

W Franklin av, bet Lindley and Pleasant av, stone dwell; cost, \$25,000; o, S. F. Hance.

Cor Lake st and Aldrich av, addn church; cost, \$18,000; o, Congregational Church Society.

Cor 2d st and 11th av S, warehouse; cost, \$19,000; o, Anglo-American Packing Company.

10th st N, bet 1st av and Hawthorne, br store and flat; cost, \$15,000; o, A J Finnegan.

6th, bet Nic and 1st av S, br store and flat; cost, \$45,000; o, F H Peterson.

Pleasant av, bet 22d and 24th sts, frame dwell; cost, \$20,000; o and a, L. F. Groff.

Cor Nic av, and 17th st, br ten; cost, \$75,000; o, E S Buell.

Bet Nic and 1st av S, and bet 1st and 2d sts, br jail, cost, \$25,000; o, city of Minneapolis.

Hen av, bet Harmon Place and Maple, 4 br dwells; cost, \$20,000; o, F. H. Boardman.

CHICAGO.—1013-19 W Jackson, br dw; cost, \$17,000; o, Cassel & Prince; a, J W Cassel; b, Cassel & Co.

2326-28 State, br store and flats; cost, \$14,000; o, Mrs Walker; a, F Baitmann; b, C W Moses.

519-27 Ashland av, brand st church; cost, \$40,000; o, Emanuel Lutheran Church; a, Fred Ahlschlager; b, Wm Schwerin.

731-33 N Ashland av, br storehouse; cost, \$9,000; o, J Wilks Ford.

159-61 Ogden av, br sloop and flats; cost, \$12,000; o, Geo E Stoneham and A E Havens; a, A Smith; b, J O Connell and Tobin & Racraft.

22-24 Scott, br dw; cost, \$17,000; o, Roos; a, H M Hansen; b, M J Benson.

23-29 Quincy, br st and office bldg; cost, \$175,000; o, C C Heisen; a, Jno Duncan.

353 Clybourn av, br store and flats; cost, \$10,000; o, E G Halle and J P Hand; a, Addison & Fiedler; b, Chas Thiele.

676-78 W Jackson, br flats; cost, \$12,000; o, R S Cox; a, C L Stiles; b, J W La Croix.

1181-83 Washington Boul, br flats; cost, \$18,000; o, Simon Foley; a, C A Weary; b, F Guerra & Co.

601-03 N Clark, br store and flats; cost, \$14,000; o, H F Waite; a, W H Drake; b, Connelly & Sons.

431-35 Centre, br dw; cost, \$20,000; o, C W Hansen; a, H R Wilson; b, Jos Hodgson.

3352 Calumet av, br dw; cost, \$10,000; o, Chas J Furst; a, Furst & Rudolph; b, A Beimoldt.

171 Townsend, br flats; cost, \$10,000; o, Landskoog & Friberg; a, Jno Otter; b, And Almer.

3615-17 Prairie av, br dw; cost, \$15,000; o, T S Walker; a, Sargent; b, F S Walker.

3429-35 Park av, br dw; cost, \$24,000; o, Welce & Lowden; a, Beman & Parmenter; b, Walter Ellis.

779-89 Loomis, br office and factory; cost, \$12,000; o, Maxwell Bros; a, Lutken & Thiessen; b, T Tobiasson & Co.

MILWAUKEE, WIS.—Ogden st bet Market and E Water, br blk of stores; cost, \$10,000; o, Peter Schmidt; b, J. Gneisler.

Cherry st nr 5th, boiler house; cost, \$10,000; o, J Obermann; b, C Schleusted & Son.

17 bldgs less than \$7,000.

WEST BAY CITY, MICH.—The Michigan Central Railroad will build a new depot at this place; cost, \$15,000.

BUILDING INTELLIGENCE.

BERGEN POINT, N. J.—The New Jersey Athletic Club has purchased ten acres of land, costing \$30,000, on Newark Bay, on which they will erect club and boat houses.

HARRISBURG, PA.—No new work to report this week of a value over \$7,000; quite a number of houses going up of a value from \$2,000 to \$5,000.

In progress, new Telegram bldg for the Sunday Telegram Publishing Co; A Hughes, builder.

Residence of Wm M Donaldson; a, Smith & Warner.

Residence of J H Bohn; a, same as above.

Nearing completion, residence of James Russ; a, same as above.

STEELTON, PA.—In progress, new school bldg; a, Smith & Warner.

Foundation nearly completed for fire engine house; same architects.

AVONDALE, ALA.—The Birmingham Flouring Co. will put in a 70-horse power engine and boiler, planers, molders, etc., to increase their plant to four times its present capacity. A building for storage purposes will also be erected and a dry kiln with a capacity of 40,000 feet.

LOS ANGELES, CAL., is to have a \$50,000 hospital.

WEST SUPERIOR, WIS., is receiving bids for a \$10,000 school-house.

PHILIPSBURG, KAN., contemplates the erection of a hotel to cost \$10,000.

ALLEGHENY, PA.—No bldgs this week over \$7,000 in value.

PASADENA, CAL.—Pasadena av and California, green sandstone foundation and base, fr dwell; cost, \$45,000; o, Colonel Markham; a, Butterworth; b, Geo D Webster.

The Grand Opera House, cor California Street and Raymond Avenue, is mostly finished by the contractor for the exterior. It is expected to be finished by January 1, 1888.

WEST BAY CITY, MICH.—The Michigan Central Railroad will build a depot here at a cost of \$5,000.

LOS ANGELES, CAL.—The corner stone of a female college has been laid.

MACON, ILL.—It is expected that the project to erect a new county court-house may fall through. It is found that the \$55,000 to be raised by a 75-cent tax limit will not pay the cost of building this year. The question will probably be submitted to a vote of the people in 1888.

ST. PAUL, MINN.—Chicago av, nr Custer, 2 story market and dwell; cost, \$19,000; o, Anglo-American Provision Co.

60 minor permits, \$48,000.

DAYTON, O.—Nothing new over \$7,000.

BAKERFIELD, CAL.—The Grand Lodge of Masons of the State of California laid the corner stone of their new Masonic Temple at this place on the 1st inst.

PALESTINE, TEX., is to have a public school house bldg costing \$25,000. Fifty bonds of \$500 each will be issued shortly.

WEST SUPERIOR, MINN.—The Land and River Improvement Co. will erect a \$100,000 hotel.

MINNEAPOLIS.—W H Dennis has completed plans for the \$25,000 bldg to be built by H A Towne, on 1st av. The lower stories are to be of red granite, with stone and ornamental brick above.

Sidle, Fletcher & Holmes have taken out a permit to build an 8-story stone elevator adjoining the Northwestern mill at a cost of \$50,000.

BOSTON.—Haviland, near W Chester Park, brick apart; cost, \$38,000; o, a, and b, W. E. O'Sullivan.

159 West Broadway, br dwells; cost, \$11,000; o, C Loemans; a, J G Lafield; b, H B Rankin.

CHATTANOOGA, TENN.—Large broom factory on Market st; o, Fred E Champion.

BENTON HARBOR, MICH.—Large oil storage house; o, Cooper, Wells & Co.

JACKSONVILLE, ALA.—The Jacksonville Hotel Company was incorporated October 31, and all the stock subscribed. It is the intention to erect a hotel to cost about \$90,000.

LA CROSSE, WIS.—Federal bldg here; contracts to be awarded next month; cost, \$150,000.

OSWEGO, KAN., is building a young ladies' college costing \$15,000.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16. }
NUMBER 25. } PUBLISHED EVERY SATURDAY.

NEW YORK, NOVEMBER 19, 1887.

LONDON, DECEMBER 3, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid. } IN AMERICA
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid. } IN GREAT BRITAIN.

THE ENGINEERING & BUILDING RECORD,
conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. (P. O. Box 3037).
Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,

95 & 97 FLEET ST., LONDON.

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British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5. The date when the subscription expires is on the Address-Label of each paper, the change of which to a subsequent date becomes a receipt for remittance. No other receipt is sent unless requested.

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LESSONS FROM THE RECENT WATER-WORKS DISASTERS.

WE have constantly urged upon those who have charge of the expenditure of funds for the construction of engineering works, whether public or private, the necessity for providing for skilled superintendence of such works from the beginning of their design to the conclusion of their construction.

Our words have sometimes been heeded, but more frequently have, we regret to say, fallen on heedless or unwilling ears. In the present extraordinary development of water-works construction, the neglect of this essential prerequisite to safety has been very marked, and we have been confidently expecting the collapse of many of the "tin-pan" works which have been built by ignorant and incompetent men under contracts or franchises granted by ignorant and careless officials, in which no provision has been made for inspection of the work in any way from beginning to end. We did not anticipate, however, that in a single day three such striking illustrations of the folly, not to say criminality, of such conduct would be simultaneously afforded as the bursting of the Little Rock reservoir, the collapse of the Seneca Falls stand-pipe, and the fall of the Franklin water-tower.

In the Little Rock case, the catastrophe was nothing more than any sensible man who knew the principles of hydraulics and the practice of good masonry construction would have predicted. The whole matter was absurd. But in the case of the water-towers which gave way, the conditions were such that a combination of knave and fool would have seemed to be essential to produce the result which took place. But, then, everybody knows that that combination did not exist in these cases. The towers were both built and owned by a person who erected them as a business enterprise, to maintain and draw a revenue from. He had had many other similar works built, and there was no inducement for him to either put in bad material or slight the workmanship. But he did not take the pains to find out whether the work he ordered was done scientifically or safely. Mr. Norman makes no claim, we believe, to either technical knowledge or practical skill, and he evidently has not, up to this time, appreciated the value of these two essentials to good design and construction. We hope that this will be a lesson to him and that he will hereafter, when he has an important construction to build, see to it first that the material is good, and next that it is not subjected to strains which it cannot bear.

Whatever may have been the immediate cause of these disasters, there is no question but that the work was designed and executed without any competent engineering advice, and there is almost as little question that had such advice been taken in season, all these structures would be standing intact and useful to-day, instead of lying shapeless wrecks in the midst of disappointed and disgusted communities.

No class of work requires more faithful execution than that which is to sustain a fluid mass.

The important question now is, How is the public to be protected against accidents of this character? The public officials who grant franchises to private individuals or corporations should require works which may affect the public safety to be inspected and approved, both as to design and execution, by competent civil engi-

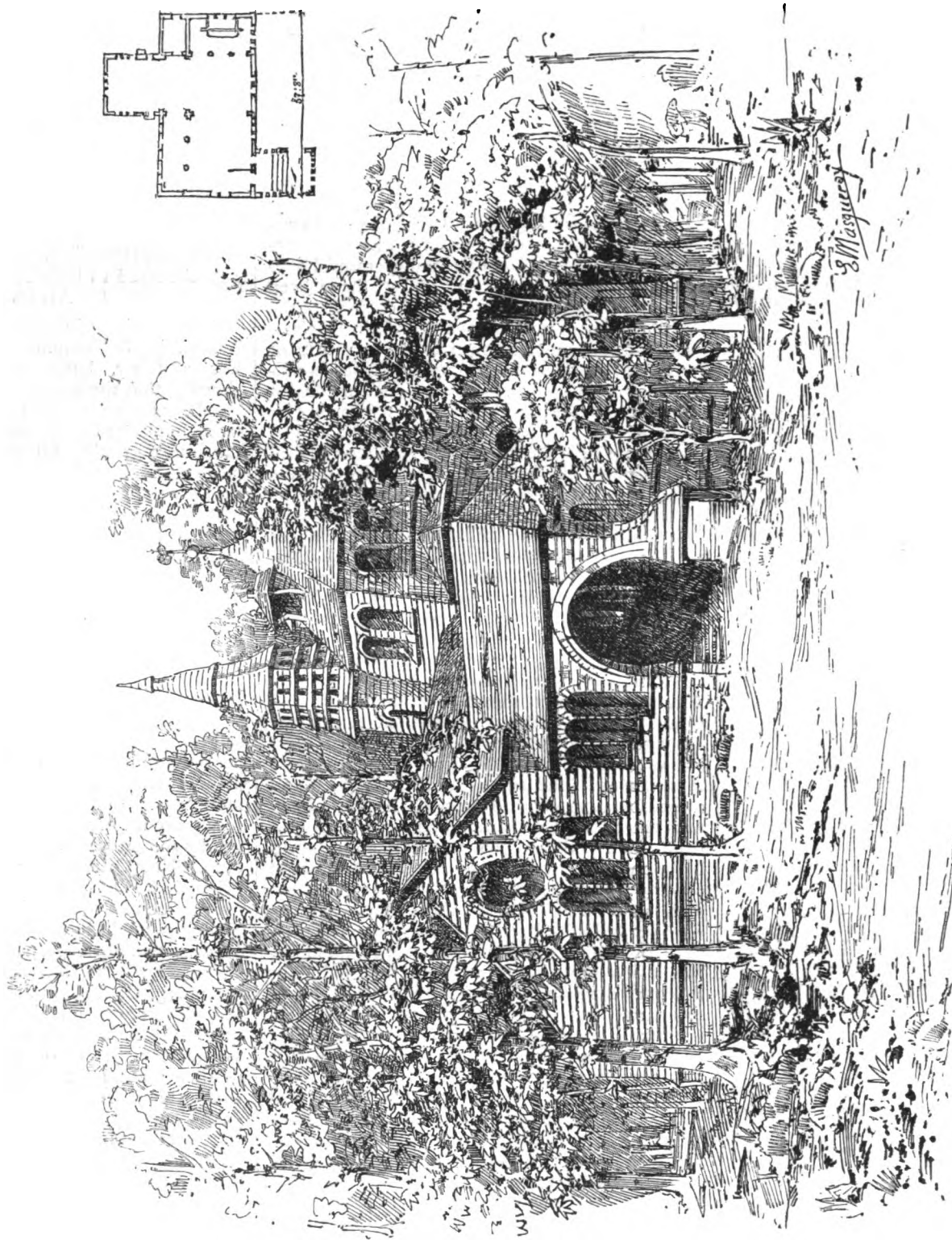
neers. If they will not do this of their own accord they should be compelled to do so by legislation.

It would be a good plan for every State to provide for such inspection by a civil engineer of recognized standing in his profession and experience in hydraulic design and construction, a stipulated fee to be paid for the service. With such supervision, blunders which are so near being crimes as those at Little Rock, Seneca Falls, and Franklin would not be likely to occur.

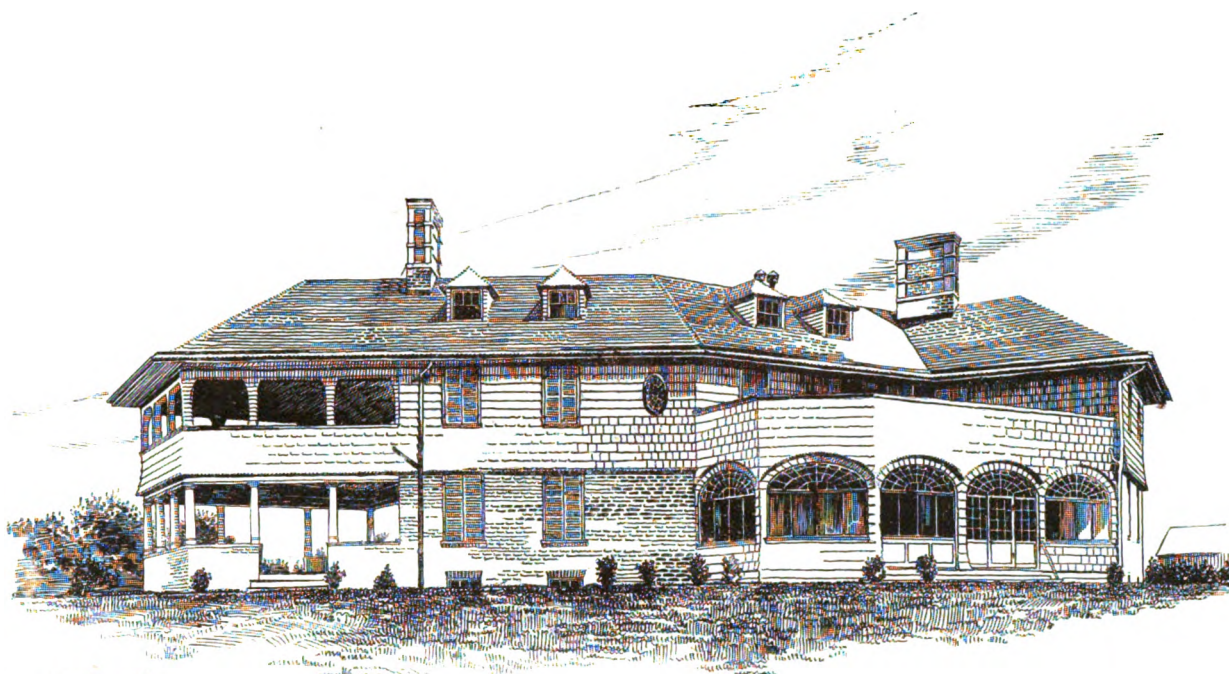
THE AMERICAN PUBLIC HEALTH ASSOCIATION AND NATIONAL QUARANTINE.

THE meeting of the American Public Health Association in Memphis, Tenn., November 8-11, was a fairly large and representative one, showing that the interest in its work continues on the part of the older members, while the large number of new members elected is a hopeful sign of growth and progress. The place of meeting is one of special interest to American sanitarians, because of its peculiar connection with the last great outbreak of yellow fever in this country in 1878-9, and because of the results which have followed efforts at municipal improvement in it. Some of these results, as stated in the address of welcome to the association by Mr. Clapp, are, that instead of the nine miles of decaying wood pavement of 1879, the city now has 25 miles of good stone and gravel pavement; instead of four miles of defective private sewers, it has 45 miles of well-laid pipe sewers, with a corresponding series of pipes for soil-drainage; instead of a death-rate of 35 per thousand, it has a death-rate of under 20; its population has nearly doubled, and its trade has more than doubled. But while these gratifying results are largely due to local effort, they are not wholly so. If yellow fever had not been kept out of New Orleans and the lower part of the Mississippi Valley for the last eight years by quarantine and sanitary inspection the history of Memphis might have been a very different one. It was, therefore, proper and timely that the President of the Association, Dr. George M. Sternberg, U. S. A., in his address, should, as he did, devote considerable space to quarantine questions and urge the need for a uniform and satisfactory system of dealing with imported pestilence at all our ports. His views are those which this journal has advocated for the last six years—namely, that we should have a National Bureau of Public Health, with a Commissioner at its head. In connection with this bureau, he thinks that there should be an advisory Board of Health, without executive power, composed of the Presidents of State Boards of Health and of the Surgeon-Generals of the Army, Navy, and Marine Hospital Service. The composition of such a board is a matter of secondary importance: the main thing is to have a central bureau under a single head and provided with ample means for the work which it ought to do.

One of the chief reasons for a quarantine system under national direction alluded to by Dr. Sternberg is the fact that it is not just or expedient that the cost of a particular quarantine station should be met by a tax on the commerce of that particular port. The service rendered is for the benefit of the whole country, and it should be paid for from the general fund. Moreover, in a system which depends on local fees improper



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motives for certain regulations will always be suspected, and sometimes justly so. To establish and maintain a national system of quarantine in spite of the opposition of those who are pecuniarily interested in maintaining the present want of system will require the influence of the commercial interests of the country, for experience has shown that the opinions of sanitary and medical associations on this point have little weight with Congress; but this is no reason why such associations should abandon effort in this direction, and we are very glad to see that the subject was brought up for consideration at the Memphis meeting.

THE NEW YORK CITY HALL ARCHITECTURAL COMPETITION.

We have expressed our disapproval of the scheme to destroy architecturally the present New York City Hall and to wipe out much of the small remnant of City Hall Park, yet since our authorities have instituted a competition for designs, presumably in good faith, and expect to get something of merit, it is proper to discuss the terms of the competition, both as showing their want of appreciation of a good architect's services and in the interest of good architecture. This appreciation is so clearly lacking on the part of Mayor Hewitt and his colleagues that it is fitting to call attention to the very unwise and unfair provisions of their circular invitation to competitors in this important competition.

The proposed buildings—by reason of the extensive and intricate character of their requirements, their peculiar relation to existing buildings, and their probable cost—give rise to a problem whose solution will require most cautious and careful handling.

As a subject for competition it is perhaps the most important we have yet had in this State.

The external treatment of a building which shall bind together two such dissimilar structures as the City Hall and the Court-House appears to be a most hopeless and forlorn subject for a competition.

Let us consider the conditions: The City Hall, in two distinct stories, refined, pure, delicate—a charming Renaissance building; the Court-House, two stories, treated as one by means of a colossal order, coarse, unstudied, ugly—a bastard Renaissance of the most objectionable kind; and, finally, an addition to this latter of a wing designed in a species of Romanesque.

These are the unrelated parts which it is desired to unify by means of a six-storied pile, which—as far as its relation to the present buildings go—could be neither “fish, flesh, nor fowl.”

This, however, is a question for the future.

The matter which we desire to notice at this time is the compensation offered to competitors. The committee offer as prizes for what, in their opinion, is a successful solution of their problem, five varying sums of money aggregating \$15,000; and provide that “the premiated plans shall become the property of the city, and may be used and combined in any manner which the commission may approve,” and “no obligation shall be created by the acceptance of any plan to employ the author thereof as the architect to construct the building.” They also require a specification of such detail that working drawings may be made and an estimate of cost of such nature as to admit of an intelligent modification of plans if desirable.

Let us see if they are offering a fair price for what they hope to receive.

The proposed buildings—for, as far as design goes, there are two of them, totally different in their requirements—cover an area of some 70,000 square feet, and will have a cubic contents of about 8,000,000 cubic feet. Their cost will certainly be not less than six millions of dollars, and in all probability nearer ten.

The accepted rate of commission for preliminary sketches is one per cent., but in work of this magnitude would be put at perhaps one-half of that, though the full rate would not be too

much when it is considered that specifications and a detailed estimate are required. In brief, the committee offer as premiums to five men less than one-half the sum they should properly pay to one, and furthermore take away from each the property right in his drawings.

They require that the City Hall and Court House be measured and drawn; they require fourteen sheets of plans, two of sections, ten of elevations, and two perspectives, in all twenty-eight drawings, beside specifications and estimates, and for this they offer to the first premiated design the sum of five thousand dollars.

Add to this that the authors of such premiated designs are assured that they will not necessarily be employed to execute their designs or even to draw them to larger scale; that when they deliver them to the committee they give up all right and title to them upon the payment of a sum which will hardly pay for the time of draughtsmen employed to make them, and that they may be enlarged, detailed, and carried into execution by the employees of the Department of Public Works.

There is little to console an intending competitor in the consideration of these facts. It is all loss and no gain.

There is no doubt that many men will enter this race—in which there may be no prize—but there is great doubt whether any of even the second rank in the profession will be found among them.

Because some architects demean themselves and their profession by unsightly scrambles for place and preferment, it is no excuse for the Mayor and authorities of this city to treat the profession so meanly and contemptuously as they do in the conditions of this competition. It can only be said that so little inducement is offered that there will be small reason for any one who enters the competition to claim he has been taken advantage of.

THE CHICAGO DRAINAGE COMMISSION.

THE letter of the Chicago Drainage Commission given elsewhere in this issue should interest all persons who, as taxpayers, have to bear the expense of the investigations preliminary to undertaking an important engineering work.

Few persons would fail to recognize the loss incurred by the interruption of work on any important construction. The disorganization or disbandment of the working force, the deterioration of the plant, and the damage by the elements to uncompleted and perhaps unprotected work are too obvious to escape notice. In stopping a half-finished investigation, the loss, though less apparent to the eye, is proportionally even greater in fact, for, as is well said by the Commission in reference to this case, “when the present employees go out they will carry with them a large percentage of the results thus far gained, greatly to the loss of the city, because much of the matter will have to be taken up *de novo*, which can only be prevented by having them complete their unfinished tasks.”

If it is unwise to swap horses while crossing a stream, what shall be said of the man who parts with his horse when half way over expecting to get another later on wherewith to complete the passage.

It is to be hoped that Mayor Roche will reconsider his action, but it is well meantime that Mr. Hering and his colleagues should have so clearly and forcibly remonstrated against it, and it is due to these gentlemen to say that they appear to have no pecuniary interest in the present continuance of the work, but rather the contrary, as Mr. Hering's contract with the city is understood by him to cover the making of a final report.

THE PROPOSED AUSTRIAN TELEPHONE SYSTEM.

THE Austrian official *Gazette* of October 11 states that the Austrian Government proposes inaugurating a system of State telephones, in connection with the post and telegraph offices. The idea is not to establish telephone

stations in towns where private enterprise has already done so. According to the proposed arrangement, the Government will connect any building with the telegraph office for telephonic transmission or reception of letters, cards, telephones, telegrams. One may dictate, for a slight additional charge of two cents, telegrams, letters, cards, etc., through the telephone to the post or telegraph office, for transmission to any part of the world, and they will receive and read the contents of letters, telegrams, etc., to you through the telephone. This new style of message is called “phonogram.” The Government intends to charge according to distance for the installation of the plants or wires to the buildings to be connected.

AMATEUR MUNICIPAL ARCHITECTURE.

UNDER this title the *Record and Guide* criticises the unfortunate scheme of Mayor Hewitt and his colleagues to erect more municipal buildings in the City Hall Park, and very properly says:

“The scheme is absolutely destructive of all repose, all dignity, all beauty. If any architect had submitted it as a solution of the problem how to place a building for the needs of the city on the City Hall Park, so as to interfere as little as possible with the public use and enjoyment of the park, he would have ruined his professional reputation. The authors of this plan have no professional reputation to lose, but they have made it impossible for any worthy result to come out of the buildings for which they have invited plans, after themselves imposing a plan which no competent architect will try to treat because he thinks he can design something worthy of the purpose, and will only treat at all in case he imagines himself to possess a ‘pull.’ It is true that the Commissioners permit the modification of the plan in detail ‘within reasonable limits.’ But no tinkering of detail will convert their plan into anything suitable. They have made the ruinous mistake of supposing that architectural advice was not needed in order to solve the problem, and that an architect could do something with a building already spoiled by the crudities of amateur planning. Their plan is the product of that rashness which goes with entire inexperience and assumes that the first thing that comes into a man's head is a final and complete solution of his problem.”

DISINFECTION AT THE NEW YORK QUARANTINE.

DR. G. M. STERNBERG, in his address as President of the American Public Health Association, delivered at Memphis, November 8, 1887, gives the following account of the ceremony performed at the New York Quarantine as observed by him when entering that port last August on a vessel from Brazil:

“As another illustration of the evils arising from the present system of supporting quarantine establishments, I will mention a circumstance which occurred upon our arrival at the port of New York. With the deputy health officer, who boarded our ship, came a man with a jug. I was informed by one of the officers of the ship that he was to disinfect the vessel. Being somewhat curious to know the method of disinfection employed, I asked the ship's surgeon to go with me to inspect, when, after a detention of less than one hour, we had started from the quarantine station for our wharf. We found that the man with the jug had lowered a bucket by means of a rope through one of the hatches between decks. Upon pulling up this bucket I found that it contained two or three pounds of some powder which had been wet, probably with acid solution, and which gave off an odor of chlorine. No doubt when first lowered between decks there had been a considerable evolution of chlorine, but in the vast space to be disinfected, it was so diluted that at the end of an hour I did not detect the odor of chlorine gas when I lifted the hatch, and it was only by approaching my nose to the bucket that I was able to ascertain what disinfectant had been used. The most curious part of the story is that I was informed that the bucket had been lowered between decks to disinfect a quantity of hides which were stored in the hold. What was the object of this ‘disinfection’? Evidently not to disinfect, for no one at the present day would think of maintaining that the hides in the hold had been disinfected by the procedure of the man with the jug.

“The only object that I can conceive of depends upon the fact that there is a fee for disinfecting, which must be paid by the agents of the ship; at least I was so informed by one of the officers of the ship.”

OUR ARCHITECTURAL ILLUSTRATIONS.

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THE subject of our illustration is the Presbyterian Church at Oceanic, New Jersey. It cost \$5,500, including pews, stained-glass windows, and wrought-iron fixtures, chancel and pulpit. The exterior is entirely of cedar shingles, brick foundation. Outside shingles left natural, inside oiled. Accommodation for 275 people. Carriere & Hastings, of New York, were the architects.

THE GETTYSBURG CYCLORAMA BUILDING.

THE iron building for the exhibition of the Cyclorama of Gettysburg, G. W. & W. D. Hewitt, of Philadelphia, architects, was designed and built by the New Jersey Steel and Iron Company, Trenton, N. J., for Mr. C. L. Willoughby. It was first erected in Brooklyn in the summer of 1886, and is now just re-erected in this city, whence it will in turn be removed to other localities.

The requirements for this building, to meet the unusual conditions of its nomadic career, have been successfully filled by the design, which secures strength, rigidity, and symmetry, with the essentials of simplicity, lightness, plain details and convenience, rapidity and economy of erection without special workmen. The trusses are, admittedly, very light, having little but their own weight to carry, and the wind strains diminished by the curvature of the surfaces and distributed throughout the whole structure by the unusually complete lateral systems, while the columns, well-braced, and anchored to the piers, form with the continuous corrugated iron sheathing a very strong wall.

All the members of all the trusses and the other separate pieces are duplicates, the field connections simple, well-arranged, and fastened entirely with bolts, those of the trusses and columns being made with taper bolts turned to fit a corresponding hole accurately reamed by a special tool after assembling of pieces. These bolts have given excellent satisfaction, secure complete bearing, and draw the pieces together as tightly as rivets.

The canvas is supported by a ring 120 feet in diameter, made of 8-inch channel-bars attached beneath the roof trusses at the end of the lower chord and bracketed directly to the columns.

This ring was required to be very accurately constructed, so as to cause the ends of the canvas to exactly meet and preserve the continuity of the painting. This was perfectly accomplished by bending the channel sections to a template and facing the ends in a rotary planer to the required angle of $22^{\circ} 30'$. Wind strains were figured for a maximum pressure of 25 pounds per square foot on an area slightly smaller (to allow for the diminished resistance offered by a curved surface) than that of a vertical section of the entire building.

The total iron weight of the structure, exclusive of corrugated sheathing, is 200,000 pounds, and the contract price, inclusive of erection and exclusive of foundation piers and roof covering of boards, tin, and glass, was about \$10,500.

SOME DETAILS OF WATER-WORKS CONSTRUCTION.

No. IV.

BY WILLIAM R. BILLINGS, C. E.,
Superintendent of Water-Works, Taunton, Mass.

(Continued from page 583.)

PIPE-LAYING.

Cement-Lined Pipe.—Wrought-iron pipe after being lined with cement is not ready for immediate use. It should be allowed to dry for one or two weeks, the time varying with the weather, and the readiness with which the mortar sets, and a careful man will not subject the finished pipe in the trench to pressure for five weeks after laying, unless the pressure be very light. No derrick is needed in laying this pipe, for if circumstances do not allow the men on the bank to hand the lengths to their comrades in the trench as easily as they could lift a piece of stove-pipe, two pieces of rope will furnish means for easy lowering.

The cement bed and covering is "mud," in the language of a cement-pipe-laying gang, and is mixed sand and cement, three to two, in a mixing-box on the bank.

It may be conveyed to the trench in any convenient manner; in V-shaped troughs, ten feet long, with handles at each end, or in pails, or in wheelbarrows. Before placing a length of pipe, a bed of a dozen pailfuls of cement is spread along the bottom of the trench, thicker than the covering desired, and the pipe, with the rivets down, is pressed firmly into it; "mud" is then brought in sufficient quantities to allow the pipe to be plastered an inch in thickness, leaving the joints uncovered. The cement is spread with rubber mittens, and the men in the trench who handle the "mud" wear rubber leggings.

The joints are covered with pure cement, and are often made by the foreman of the pipe-layers, who can easily keep ahead of his men, for to a practised hand the operation is simple and rapid.

The exposed pipe-ends are first covered with cement even with the finished pipe, and a sheet-iron sleeve is then slipped along so that its centre is directly over the joint. A pin of $\frac{1}{4}$ -inch wire stuck into the trench will locate the butt joint of the two pipes, and make the placing of the sleeve an easy and certain matter, and the sleeve is then in turn covered with the pure cement.

This pure cement will crack, perhaps, and must be patched, and for this the regular "mud" will answer.

To protect the covering from too sudden drying, the pipe should be lightly covered as soon as it is laid, but the final covering should be delayed forty-eight hours.

The specials for cement-lined pipe can be made by any good sheet-iron worker.

Tee and Y branches are to be soldered at their junction and strengthened by knees of $\frac{1}{4}$ -inch flat iron, one inch wide, riveted to the metal.

Plugs are simple cylinders filled solid with "mud," but they are to be braced in the trench with a heavy stone.

JOINT-MAKING.

There is not, to my knowledge, any standard form for a cast-iron pipe-bell or socket. This is unfortunate. The lack of agreement in this particular is, it is true, not nearly so unfortunate as the still greater lack of uniformity which prevails in the thicknesses which are specified for cast-iron pipe, but a standard is desirable.

The general form of a bell and spigot pipe-joint is shown in Fig. 15.

In practice, the two lines which in the sketch run through the word "and" should form one, and they will when the spigot end is pushed "home." A space is left in the sketch to make the parts more distinct. A water-tight joint capable of standing great pressure is secured by using a soft compressible substance in combination with molten lead. For the first substance one may use jute, hemp, old rope, old rigging, oakum, or almost anything of this nature, as the principal office of the "yarn," as it is oftenest called, is to prevent the molten lead from running into the pipe. It has been suggested that the yarn in the joints of a distributing system may, by its compressibility, serve to mitigate the shocks which come from water-hammer, and again that the yarn will in time decay and may then furnish feeding-ground for noxious animal or vegetable life which may appear at one time or another in any water-supply.

At present these suggestions belong to that class of problems which are of especial interest to the investigator. Of the first we may say that it has a reasonable appearance, and of the second, that if it be true the elastic cushion is lost when decay is complete.

The writer's experience has led him to adopt for yarn the article known to the cordage trade as 12-thread Russia gasket, tarred.

A larger size may be needed for 24-inch and 48-inch pipe, but the 12-thread has worked well on all sizes up to and including 16-inch.

For lead, use any soft pig, such as the "Omaha" or the "Aurora" brands.

In a gang of fifty, one man can find enough to do in yarning and pouring the joints. Let the yarn be cut into pieces long enough to go around the pipe and lap a little.

The yarner takes a bundle of these "ends" as large as he can conveniently carry from one bell-hole to the next,

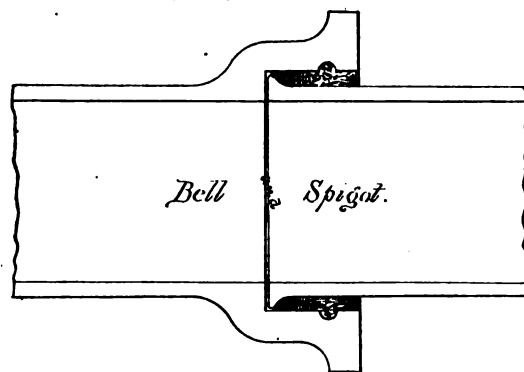


FIG. 15.

a couple of cold-chisels, a yarning-iron, and a hammer, and, going to the first joint that is ready, he should to begin with see that the joint room is even, or alike all around the pipe, and if it is not the chisels should be driven into the small places so as to crowd the pipes into line. This, of course, provided the pipes are intended to be in line, and one is not trying to get around a curve by "taking it out of the joints." The relative amounts of lead and yarn

to be used per joint do not seem to be determined by any hard-and-fast rule. Referring to Fig. 15 we can see that there is little except stiffness gained in putting in more than enough lead to reach back of the semi-circular groove, say one-quarter or one-half an inch, so that the depth and form of the bell must determine to a great degree the exact depth of lead in the joint.

Yarn is cheaper than lead, but the time consumed in yarning may, with lead at a very low figure, make it cheaper to put in only a shred of yarn and save time by filling up the joint with lead.

I think some contractors have figured in this way, for joints of their making which I have had occasion to dig up seem to have been made upon that principle.

Tarred stuff of some sort packs better and is easier to handle than dry rope or strings. The tarred Russia gasket, bought in 100-pound coils, is convenient to use for slings and lashings, and is just as good as ever for yarning after any other use. To guide the molten lead into the joint, we must have either a "roll" made of ground fire-clay upon a rope-yarn core, or a jointer. If a jointer is used, the yarner carries it with him in the trench, but a clay roll must be kept in shape and ready for use by the lead-boy. The patent jointers are made of canvas, rubber, and sheet-steel. They are very convenient, and can be obtained of dealers in water-works supplies. They are especially useful in wet places, for they do not easily blow out if a little steam is formed, and the clay-roll will frequently give trouble in this particular. For making a good clay-roll we require finely-ground fire-clay, a piece of board somewhat longer than the finished roll, a strand of rope, and a pail of water. Mix two double handfuls

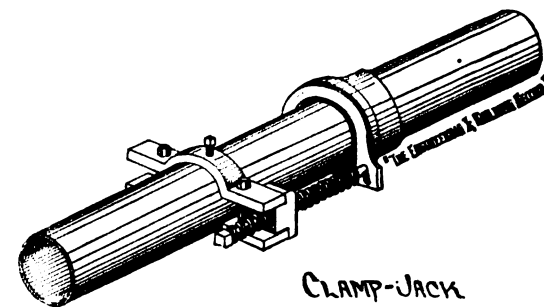


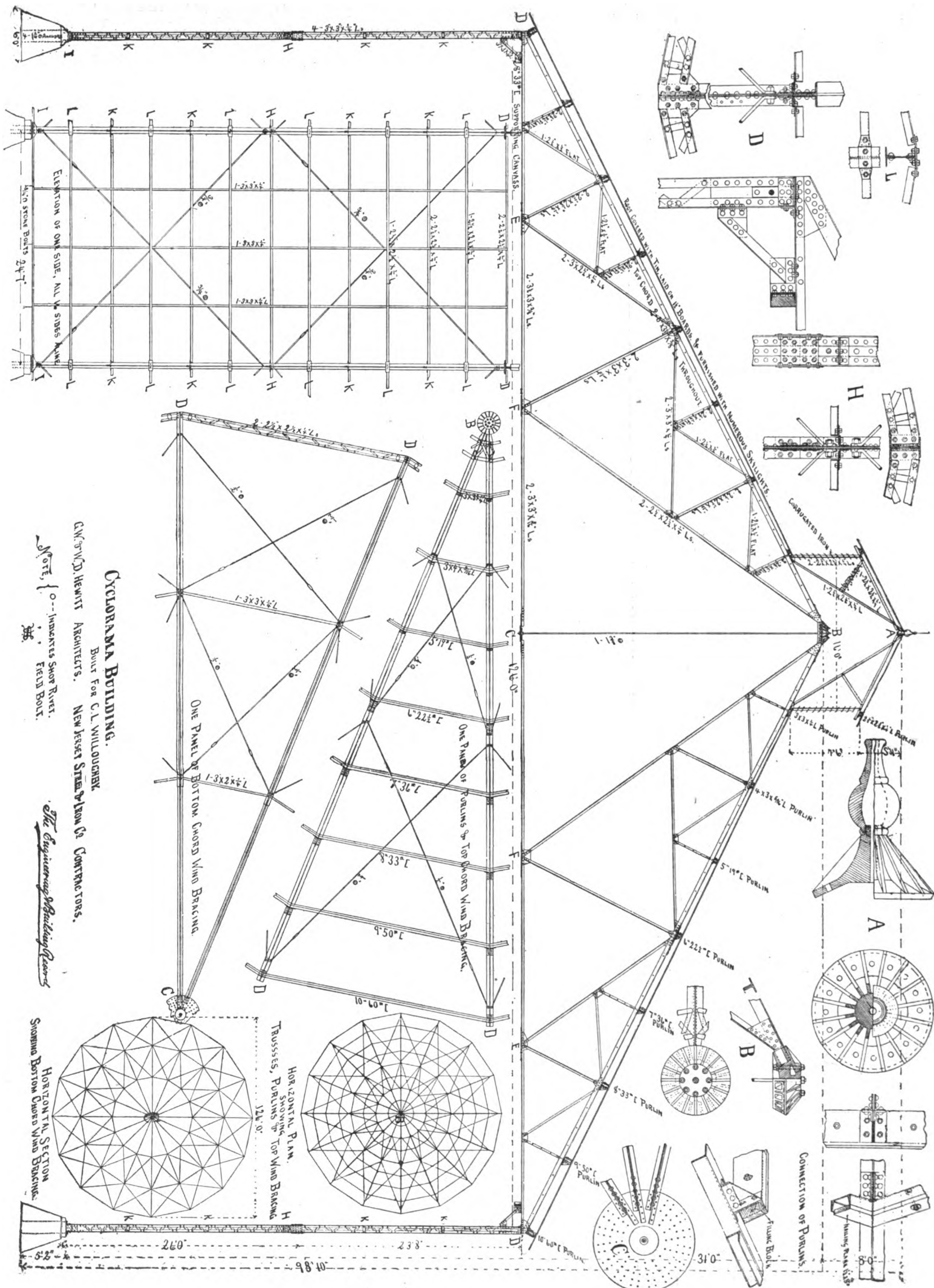
FIG. 16.

of the clay into dough, and after enough kneading to get out the lumps, roll the mass into a short thick club. With a stick or a chisel cut a slit lengthwise of the club and half-way through it, and lay therein a strand of rope a foot longer than the outside circumference of the pipe. Bring the two edges of the slit together, and then, by working, stroking, squeezing, wetting, and rolling, the roll may be drawn out to an inch in diameter, and eight or ten inches longer than the outside circumference of the pipe. This roll-making is the work of the lead-boy, who should keep the roll, when not in use, lying on the board covered with a wet cloth, and mend and wet it as the wear and tear demand. When he has packed the proper amount of yarn into the joint, the yarner should call out "roll" to the lead-boy, who will bring him the roll by the two rope-ends.

The roll is wrapped about the pipe close to the bell, bringing the two ends on top, and turning them out along the pipe, so as to form a convenient pouring-hole. The roll should be pressed firmly into place against the bell, and the molten lead poured in not too rapidly. The lead should be hot enough to run freely, and the furnace should be frequently moved, so that the hot lead need not be carried far enough to give it time to cool. After the joint appears to be full, and the roll has been removed, the yarner should examine the joint carefully all around, and especially on the bottom, to make sure that the joint is well-filled; and if a cavity is found it should be filled by a second pouring if possible, or by a plug of cold lead. The calker follows, and should begin on the joint by using his chisel, cutting off the lump at the pouring-hole, and then driving the tool lightly between the lead and the surface of the pipe all around. Having, by this operation, lifted the lead away from the pipe, he begins with the smallest tool and drives back the lead, a little at a time, all round, and, following with the larger tools, sets the metal in firmly with strong, even blows.

Calking is hard work and needs a muscular man to follow it steadily, but it is not enough that he be—

"Darbyshire born and Darbyshire bred,
Strong in the arm and thick in the 'ed,"—



CYCLOPAMA BUILDING.

Built for C. L. WILLOUGHBY.
 G. M. & W. D. HEWITT ARCHITECTS.
 NEW JERSEY STEEL & IRON CO. CONTRACTORS.

NOTE: { 0--- INDICATES SHOT RIVETS.
 { --- FIELD BOLT.

The Cyclorama Building Co.

HORIZONTAL SECTION
 SHOWING BOTTOM CHORD WIND BRACING.

HORIZONTAL PLAN.
 TRUSSES, PURLINS & TOP WIND BRACING.

ONE PANEL OF BOTTOM CHORD WIND BRACING.

ONE PANEL OF PURLINS & TOP CHORD WIND BRACING.

for he should know when a joint is right, but above all he must be trustworthy and faithful, and certain to call attention to any joint that he cannot get into proper shape without help. The quantity of power required to pull apart a well-made bell and spigot joint will surprise one who sees it measured for the first time.

In the experience which the writer has had in endeavoring to pull apart such joints the amount of force applied has not been measured with exactness, but a heavy clamp-jack having a pair of $1\frac{3}{4}$ -inch screws with four threads to the inch, worked with a lever about thirty-six inches long, was insufficient to pull apart any but pipe from which the rim or bead on the spigot end had been cut off, so as to leave a smooth end.

Some notion of the force applied to the joints by this clamp-jack, Fig. 16, may be had by using the formula for power exerted by screw given in *Goodeve's Mechanics*:

$$P = \frac{w r}{a} \tan (\alpha + \theta),$$

in which

P = power applied at end of lever.

r = mean radius of screw-thread.

a = length of lever.

α = angle of thread.

θ = angle of repose.

$\tan \theta$ = coefficient of friction.

w = force exerted by screw.

Then,

$$w = \frac{P a}{r \tan (\alpha + \theta)}$$



FIG. 17.

In Fig. 17, let B A represent the developed circumference of the cylinder on which thread is traced, and P A the pitch of the thread, and P B A = α = angle of thread. Then

$\tan \alpha = \frac{P A}{B A}$ and substituting the values for this case,

calling $1\frac{1}{2}$ -inches the mean diameter of screw-thread,

$r = \frac{1}{4}$ inch. $P A = \frac{1}{16}$ inch.

$\tan \alpha = \frac{.225}{4.711} = .053$ and $\alpha = 3^\circ 2'$.

$\tan \theta = .08$ and $\theta = 4^\circ 35'$.

$\theta + \alpha = 7^\circ 37'$. $\tan (\alpha + \theta) = .133724$.

$P = 100$ pounds. $a = 36$ inches.

$$w = \frac{P a}{r \tan (\alpha + \theta)} = \frac{3,600}{.75 \times .134} = 36,000 \text{ pounds.}$$

This formula makes no account of the power expended in overcoming friction at the pivot end of the square-threaded screw, and the result above given should be reduced 15 or 20 per cent.

The same clamp-jack has been found useful in pushing a hydrant off its branch for repairs.

As to the quantity of lead used in joint-making on cast-iron pipe the following notes are offered. Four streets having a total length of 3,112 feet of 6-inch pipe consumed 1,997 lbs. of lead or $\frac{1}{4}$ lb. per running foot. Two streets, 1,796 feet of 8-inch required 1,514 lbs. of lead or $\frac{1}{4}$ lb. per running foot.

During the past season the writer has directed the laying of 10,000 feet of 16-inch, 1,915 feet of 8-inch, 1,479 feet of 6-inch, 1,817 feet of 4-inch pipe. For purposes of this calculation it is fair to say that the quantity of lead varies directly as the diameter of the pipe, and that the above is equivalent to 11,927 feet of 16-inch pipe, and to make the joints on this 23,579 lbs. of lead were used, or 1.97 lbs. per running foot. This is larger, as of course it would be, than the amount given by a single experiment on a short piece, for ten pigs weighing 96.7 each (average weight) filled the joints on 550 feet of 16-inch, or 1.75 lbs. per running foot.

The quantity of yarn used is not large, comparatively speaking, and on the three small sizes, 4, 6, and 8-inch, with the price at ten cents per pound, $\frac{1}{10}$ of a cent per foot is a safe figure for estimating purposes.

The quantity of pipe laid and the number of joints made in a day will, of course, vary greatly in different cases. If a man is trying to see how many pipes he can get into a trench, with the minimum amount of thought as to how they are put in and jointed, he can make a wonderful record, and the man who comes after him, and has to take care of the pipe-line under the shocks of service, will appreciate more keenly than any one else the value of such a record.

The following notes of actual work are offered, not in any sense as instances of model performance, but as simple illustrations: Time, July 6, 1887; gang 60 men, 16-inch pipe, 2 yarners, 2 calkers, 4 to 10 men digging bell-holes, 30 bell-holes per day, 400 feet of pipe laid and jointed in ten hours.

(TO BE CONTINUED.)

PAVEMENTS AND STREET RAILROADS.

No. XIX.

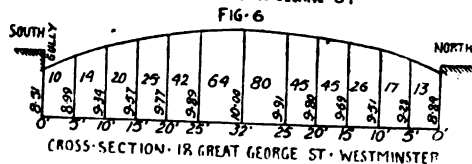
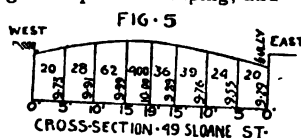
(Continued from page 680.)

WOOD PAVEMENT IN THE METROPOLIS.*

CORRESPONDENCE.

MR. G. P. CULVERWELL approved of the contour of the carriageway in Fig. 2, but thought that, if anything, the slopes might be reduced. It was ordinarily admitted that wood was a most slippery roadway, and thus every precaution should be taken. The sharp camber of the old macadam or stone pavement was too often followed, but it was unsuitable, and placed vehicles at a disadvantage, especially when starting from the curb. The cross-section should be represented by two gradients, say of 1 in 40, from the channels to the crown, the latter being slightly eased off. In level roads the cross-section necessarily varied somewhat in order to drain to the gullies.

Figures 5 and 6 were typical sections, and had been carefully taken recently. The east and south ends respectively were at gullies, whilst the west and north ends were midway between gullies, both streets being level. It was to be noted that steep gradients transversely were specially objectionable, as in this direction the blocks were made to abut close one to the other without any joint, and this gave little foothold. He did not comprehend the remarks as to pitch-pine producing a "jarring, bumping motion." He had examined the portion of that pavement in King's Road, and traveled over it in various vehicles without noticing any increase of bumping motion, but there was somewhat greater resonance than where the wood was softer. He would expect to find the coefficient of elasticity of pitch-pine greater than of yellow wood. It was misleading to say that creosoting "tends to produce premature internal decay," although, indeed, perhaps the large amount of inferior work done in the market might form a sufficient excuse. Creosoting consisted in driving out the sap, and then substituting oil. If the first portion of the operation was not effected, the oil formed merely an external coating, preventing the sap from escaping, and "dry rot" set



up. He, however, thought that creosoting was unnecessary and even in some respects undesirable for wood paving. Creosote was chiefly of use in the case of porous woods exposed on all sides to the weather, in prolonging the ordinary life of the sapwood and wood next the sap. It did not render the sapwood harder, or better able to withstand abrasion under traffic; and it was almost useless to creosote the heart-wood of pitch-pine, the wood being already so full of resin that little oil was taken in. He had no hesitation in saying that the money expended in creosoting would be better laid out in the careful selection of heart-wood timber of uniform quality; and he thought there were data to show that the life of pitch-pine pavement might, without undue maintenance, easily reach ten to twelve years as a first-class roadway under the traffic standard of 750 tons per yard width per day. The depth of block should be regulated to some extent by the weight of traffic, the aim being that the block should be fairly worn out by abrasion just before decay from weather or other causes set in. With pitch-pine, even 5 inches appeared unnecessarily deep, considering that the maximum annual wear in King's Road was given as under 0.1 inch, and in Oxford Street blocks (presumably deal), worn as thin as $1\frac{1}{2}$ inch, had not failed under the traffic.

"Top-dressing" was important, but the material used was often unsuitable and too much was put on, with a result that, upon the first rain, the roadway was almost impassable for pedestrians, as in the case of the Strand at Charing Cross when last repaved. The material should be fine-screened sharp gravel, deposited in successive thin layers. Stones of the size of walnuts only rolled about, the wood not presenting a sufficiently hard anvil to crush them, and the material did not work its way into the wood so well when in a thick layer.

The opening up of streets for repairs to gas and water mains, etc., was most objectionable, and peculiarly so in the case of wood pavement, owing to the time necessary for the proper restoration of the latter. It was to be regretted that a comprehensive scheme had not been carried out whereby to provide subway accommodation in the metropolis for gas and water pipes, telegraph and telephone wires, etc. Many of the streets were much too narrow, whilst the evil daily increased, and thus every means should be taken to supplement their deficiencies.

More information was desirable so as to be able to determine the description of wood, size of block, and width

of joint best adapted to varying conditions of traffic and gradient. He thought 1 in 20 too steep for any of the forms of wood-paving at present employed; and whenever the gradient exceeded 1 in 40, extra provision should be made for cleansing and sanding, especially in time of frost.

Sloane Street at present afforded a good opportunity for examination, as the paving and concrete foundation were being taken up throughout its whole length for a width of about 16 feet, in connection with new sewerage works. Such examination showed that the concrete foundation was clean and sound, and there was no appearance of moisture or objectionable matter having infiltrated. The blocks were not perceptibly rounded on top, and were in good condition, showing little soakage, and the cement grout bonded to them remarkably well. The cement joints were of uniform width, and were very little below the level of the blocks. The blocks were burred about $\frac{1}{4}$ inch upon the sides next the cement, and not at all at the ends where block bore against block. This pointed to the conclusion that blocks of uniform thickness, laid touching each other upon all four sides, and without any cement or other joint, would form a most durable pavement, whilst upon level roads it might give a sufficient foothold. The compression set up would effectually keep the blocks in place, and prevent infiltration of moisture. Expansion in the transverse direction of the street appeared to have been sufficiently allowed for, as the blocks bedded fairly upon the concrete, and no buckling away from it or disturbance of the foot-pavements, had been noticed. That the compression in the longitudinal direction of street was great was evidenced by the line of blocks continually cambering toward the free end. This camber averaged about one inch in the excavation width of sixteen feet. This showed the advisability of laying wood pavements in long even gradients; and where the vertical curves at the summit levels were sharp, expansion should be provided for, otherwise buckling, followed by disintegration, might take place. Compression was most desirable for wood, and directly added to the life of the blocks, whilst further preventing objectionable soakage. Hence it appeared why a rigid joint, such as cement, was preferable to a mastic one. In the latter case, in place of the wood being compressed, the substance of the joint itself was expelled, and part, no doubt (especially if the transverse expansion had not been allowed for), found its way underneath the blocks, and uneven bedding, followed by disintegration, resulted. In connection with this matter of compression appeared a direct objection to the use of creosoted blocks, as these did not expand, and compression was not set up, and also the cement grout did not bond to them as well as to plain ones. This explained the several instances noted by the author of the ease with which creosoted blocks were taken up, and of the moisture having been found between them.

He was informed of one case—that of the long-girder bridge over the River Foyle, at Londonderry—in which the cement grout had never set. This the engineer in charge attributed, no doubt correctly, to the unremitting vibration night and day, as every care had been taken with the materials. Henson's patent felt bed and joint appeared peculiarly applicable to such cases.

In conclusion he congratulated the author upon having at an early stage adopted an excellent and economical system of pavement, singularly free from faults or objections, and one that bid fair, with minor modifications only, to be largely employed in the future.

Mr. W. H. Delano regretted that the author should have perpetuated confusion by using the words "asphalt," "asphaltic," when the substances he referred to were evidently gas-tar and gas-tar-mastic—namely, gas-tar mixed with chalk and gravel. Asphalt was a natural bituminous limestone; asphalt-mastic was the same, mixed with natural bitumen, and when mixed with grit was called gritted asphaltic mastic.* He understood that pine sets cut from Swedish yellow deals six inches deep, three inches wide, and eight to eleven inches long, laid on a Portland cement foundation six inches thick, cost 10s. 6d. per square yard, exclusive of demolition of old roads, carting away old materials, and regulating the subsoil to a proper contour. This price was low and probably misleading as a guide to contractors' prices for similar work, for it seemed to include no general expenses. A contractor paid rates and taxes, interest on money disbursed, cost of plant and tools, rent employees, which made his general expenses from fifteen to twenty per cent. Local boards, who were their own contractors, had none of these to count, but it was probable that their general expenses really exceeded those of a contractor, just as the management of railways by the State cost more than that of private companies. The standard traffic of 750 tons per yard width per diem seemed a misleading formula, for the wear and tear of a road did not depend so much upon the weight passing over it as upon the speed at which that weight traveled. There was also the important element of width of tire, the state of the atmosphere, the camber of the road, and the mode of traffic, cross, heavy, one side empty the other loaded, etc., etc. Take the new three-horse Paris omnibuses carrying, when full, forty-six people including driver and conductor, weighing when full $5\frac{1}{2}$ tons, the width of the wheel tires being only $3\frac{1}{2}$ inches, running at a speed of seven to nine miles an hour, and compare the same weight on a $4\frac{1}{2}$ -feet wide smooth cast-iron roller dragged at $1\frac{1}{2}$ miles an hour. The latter improved a road, the former rapidly destroyed it.

(TO BE CONTINUED.)

* A paper by George Henry Stayton, Assoc. M. Inst. C. E., and printed in the Minutes of the Proceedings

* Minutes of Proceedings Inst. C. E., vol. 1x., p. 249.



DOMESTIC ENGINEERING, ETC., IN THE
EQUITABLE LIFE INSURANCE BUILD-
ING, NEW YORK CITY.

No. VII.*

(Continued from page 680.)

STEAM-HEATING.

In the steam-heating, no special system is strictly followed. In such a large job unusual problems arose and were met by the engineer, Mr. Wilson, as the occasion required.

The heating-main, commencing at 11 on the cellar plan and going to north wall, is 10 inches diameter and measures 56 feet to the wall; it is provided with the usual expansion-bend at 38; from this corner to the next bend, which is at the corner of Broadway and Cedar Street, it measures 220 feet; from there to valve No. 45, 75 feet, the diameter being 7 inches at the valve, the reduction being made one inch at a time. A riser is taken off the main at every pier along the route, their diameters being usually 3 inches, unless for special duty. At the corner of Broadway and Cedar Street a large copper bend, 96, of 10 feet radius, is introduced, which effectually absorbs the expansion of the two lengths. Beyond valve 45 and around the south wall back to the steam-main at 12 the pipe increases in diameter from 7 inches to 10 inches, as with the main already described. At the corner of Broadway and Pine Street a similar large copper elbow or bend, 97, is put in for expansion reasons, and found to operate much better than any expansion-joint could do.

As previously stated, the globe-valves 41 and 42 shut off the high-pressure steam from the heating-mains; when they are opened the entering steam is reduced in pressure through the reducing-valves T T. No steam risers are taken off direct, but invariably at a distance from 3 to 6 feet, to right or left of the point on the pier where it is to ascend, thus giving an easy and unobjectionable method of absorbing the expansion and one that needs no looking after. The risers are hung at a point about half-way of their length, usually on the third floor; the method of hanging is shown in Fig. 11. A piece of boiler-plate A is built in the wall or pocket containing the steam and return risers, with holes in it in sufficient number and the diameter equal to the outside diameter of the pipe. This allows for the expansion going both ways from the point of suspension, decreasing the risk of sprung joints from what would be the case if the pipe rested on beams in the cellar and the whole expansion went from the bottom up.

In the 50 miles of steam-piping in use there is not one expansion-joint of any kind, and there has been no case of leakage or trouble from not using them.

Particular attention was given to having a means of expansion in all directions in the pipes themselves by a judicious use of elbows; this is successfully accomplished, as no pipe, however obscure or small, is not provided with ample means in this direction. Perhaps the severest test of this principle adopted was at the corner of Broadway and Cedar and Broadway and Pine. Here large copper bends were used of 10 feet radius to turn the corners; the run of pipe along the north and south walls to those bends is 220 feet and along the Broadway front 150 feet, but no trouble was experienced when steam was turned on. The steam-risers going to the tower are 4 inches diameter, and are 3½ inches in several special cases. In nearly all cases one radiator on each floor is fed from one riser; in a few cases two and three are taken off. The radiators used are vertical tube return-bend pattern and number between 700 and 800.

The mains are hung from the I-beams of the ceiling by straps that encircle the pipe, their ends passing up over the lower flange of the beams and bolted together to keep from spreading. Flanges have not been used in any one case unless where absolutely necessary for a final connec-

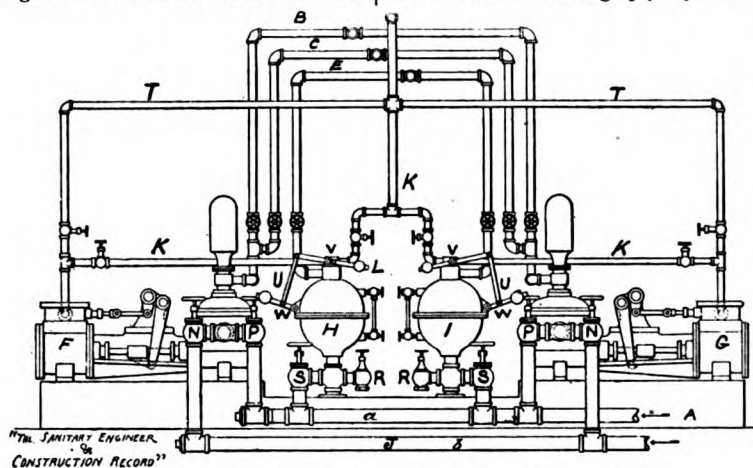
tion. This applies to the largest pipe as well as the smallest, the reason given being that flanges absorb a great deal of expensive packing which wears out, and they cannot be relied upon for permanency like the screwed joints.

Gate-valves are used exclusively in the exhaust-pipes leading to the heating-mains.

The water of condensation is returned through two separate mains, which begin on each side of the main Broadway entrance under the sidewalk. They make the circuit of the building and are of increasing diameter, beginning with 2½ inches and ending in 4-inch, as shown at the feed-pumps, Fig. 12, which is a side view of the arrangement of the pump-governors, pumps and local connections for forcing the return and fresh water into the

pipe P, and force it into the boilers through pipes B and C. The reduction of pressure made in the return by this action has the effect of increasing the flow of condensed water in the direction of the boiler from the remotest corner of the system. When part of the exhaust steam is unavoidably going to waste in spring and fall, and the return mains are not supplying enough to maintain the water-level, the valves N N, which are connected to the city water, are opened slightly so as to supply the deficiency, the water in that case passing through the feed-water heater before entering the boiler, which it reaches at a temperature of nearly 212°.

During the summer season, when the pump-governors are not in use, the whole supply of water to the pumps F and G is taken in through pipes J and valves N N, and the

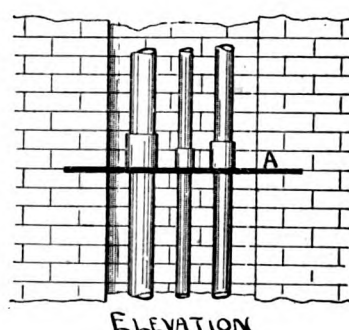


RETURN WATER PUMPS AND PUMP GOVERNORS

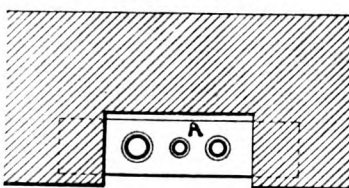
FIGURE 12.

boilers, and also keeping the level of the water in the return-mains some 4 or 5 feet below the water-line in the boilers.

In Fig. 12 H and I are the pump-governors; F and G the boiler feed-pumps; A the return-main, 4 inches diameter; J the 4-inch suction-pipe connecting with city water at storage-tanks 62 and 63; K K K is the steam-pipe connecting with the pump-governors, while T T are the direct steam-pipes which are used when the pump-governors are not in use; pipe E is an equalizing pipe, marked 92 and 93 on cellar plan, and connecting with the heating-mains on the low-pressure side of the reducing-valves T T on cellar plan. The devices are in duplicate so that the work



ELEVATION



PLAN

FIG. 11.

may not be retarded if one gives out or is stopped for repairs.

The water of condensation, as it seeks the lowest point in the mains, flows into the governing apparatus through pipe A and valves S S to the chambers H I. Here is placed a float which is connected to the levers U U, which in turn operate a regulating-valve V, which admits just so much steam to the pumps as the height of the float will allow. The office of the float being to open the valve V as it rises, and closing the valve as it falls, hence as the water of condensation increases and the float rises the valve V opens and admits more steam to the pumps through pipe K, enabling them to run faster and draw the accumulation of water out of the mains through

whole supply of steam through steam-pipes T T instead of pipes K K. The valves R R on the chambers H and I are for blowing-off purposes only. The pipes B C E are all three inches in diameter. Pipes E, corresponding with those marked 92 and 93 in cellar plan and connected to the heating-mains on the low-pressure side of the reducing-valves, T T, are for the purpose of insuring the pressure in the chambers H I being the same as that in the heating-mains, and maintaining a steady action in the working of the apparatus.

The pipe C corresponds with pipe X in cellar plan, while B corresponds with that marked Y in same. By opening valve on pipe C, and closing that on pipe B, the feed-water is forced to heater R in cellar plan and back through pipe Y, and thence to boilers through branches 46 and 47, etc., to feed-valves in front of boilers in a heated state. While by closing valve on pipe C, Fig. 12, and also valves 48 and 49 on cellar plan and opening valve B, Fig. 12, which corresponds with valve 50 on cellar plan, the water no longer goes around by way of heater R, but directly to boilers through branches 46 and 47 as before.

The main offices of the Equitable Life Assurance Society and also the main corridor of the building are heated by indirect radiation. The former by means of the indirect radiators shown in cellar plan at 98; the latter by radiators placed near the cellar ceiling immediately below the corridor. The grated openings for admitting the heat to the corridor are placed by preference in the side walls rather than in the floor, on account of the odor that arises from accumulations of earth on the grating.

The other article, on some plumbing details not yet finished, will appear in a later issue.

The architect of the building was Mr. George B. Post, of New York; the builder, Mr. David H. King, Jr.; the engineer, Mr. James F. Wilson; the master plumber, Mr. William H. Quick.

EXPERIMENTS have recently been made on the Seine, with M. Pagan's new cable anchor, for the stoppage of steamers in motion. The apparatus is a cable having on it a series of canvas cones, which open out by the action of the water, and close again when drawn in the opposite direction. The "Corsaire," going thirteen knots, was stopped in seven seconds in a space of 26 to 30 feet. For comparison, the steamer when stopped in the usual way, by reversing engines, took thirty-four seconds, and a space of 350 to 360 feet.—*Iron*, October 14.

AN interesting International Exposition will be opened in Paris on December 25. It will be devoted to all apparatus, etc., to prevent fires in theaters, for the lighting of theatres, for the extinction of fires, and for aid in case of fire.

*No. I. of these articles, containing the first installment of Sketches of Plumbing, appeared in our issue of October 8; No. II., General Description of Building and Plant, October 15; No. III., Details of Pumps and Boilers, October 22; No. IV., Smoke-Stack and Passenger-Elevator Water-Supply, October 29; No. V., The Elevators, November 5; No. VI., Pneumatic System, November 12.

SOME SKETCHES OF PLUMBING IN THE RESIDENCE OF WILLIAM F. WELD, ESQ., BROOKLINE, MASS.

No. I.

THE plumbing and drainage-work in this notable building possess numerous interesting and novel features, which we hope to make the subject of several articles.

The accompanying details and sketches show the several arrangements of the principal parts of the plumbing, etc., in the new villa residence of William F. Weld, Esq., in Brookline, Mass. The drainage was planned by E. W. Bowditch, C. E., and the plumbing-work was done by Henry Hussey & Co., the architect being Mr. E. M. Wheelright, all of Boston.

Figure 1 shows the manner of arranging the house-trap, foot-vent, etc., outside the front wall of the house. It also shows the tunnel in transverse and longitudinal sections through which the cast-iron sewer-pipe is run through the grounds to the city sewer. The same tunnel is also utilized for the water and gas pipe service. It is 30x30 inches in

placed in the pipes as to come just through the copper. Then a leaden sleeve is placed about the hub, with its upper edge turned down within it. Into this a full length of pipe is placed and a joint of lead run similar to any of the other joints of the pipe. The lower edge of the sleeve is wiped to the copper roof. The object of this of course is to make a thoroughly water-tight connection with the copper roof that will be at the same time sufficiently elastic to compensate for any slight difference of length caused by expansion or contraction or by settling.

Figure 3 shows the special grease-trap used. It is a cement cylinder, with hemispherical end set in the ground. It is 5 inches thick, 36 inches in the clear in diameter, and somewhat over 5 feet deep. The kitchen and pantry pipes enter it 2 feet 6 inches from the top and the roof water enters much higher up. About 6 inches lower than the sink and pantry pipes the level of the water and grease with the apparatus is maintained. The outflow-pipe, of course, is at this level, but, as will be noticed, the water leaves the basin at a much lower level, the end of the

The following officers were elected: Mr. John Date (Chairman); Ald. V. Grenier, Vice; Mr. J. W. Hughes, Secretary-Treasurer; Messrs. J. B. Drapeau, G. Yon, H. Garth, J. Mattinson, with the regular officers to be a Committee of Management.

Mr. Savignac acted as joint secretary and interpreter, it being the intention to conduct the affairs of the section in the French and English languages.

It was unanimously resolved that active steps be at once taken to form a plumbing class in connection with the Government trade-schools. Messrs. W. Brittan, W. M. Briggs, and F. Horton were appointed a special committee to select a teacher and make the necessary arrangements.

Novelties.

Under this heading we propose to describe and illustrate appliances of probable interest to our several classes of readers. The selection will be made without reference to the wishes of agents or patentees, being governed solely by considerations of novelty, ingenuity, and probable interest to readers, and especially the fact that they have not been elsewhere described. As a rule we shall make no comments, and it is to be distinctly understood that a notice does not imply approval. No charge will be made for these notices, and any offer of pay for their insertion will insure their omission. We shall be glad to have our attention called to novelties suitable for this section.

STEAM-RADIATOR.

THE accompanying cuts show a novel positive steam-radiator, lately patented by Ezra F. Landis, of Lancaster, Pa.

The object of the apparatus is to produce a radiator in which the sections will be easily retained steam-tight whatever may be their relative arrangement, the invention relating mainly to the construction of the joints between said sections.

The radiator as here shown and used is composed of any number of elements B B, which, taken as whole, make a coil set on end.

The steam is admitted, as usual, through the pipe *a* into the bottom of the end section A, and after ascending therein passes through the aperture into the top of one of the branches of the section B. The top of each section having a diagonal partition *b*, as shown in Fig. 2, the steam descends in one of the branches of said sections B, passes under its bend *B*¹, and ascends into the second branch thereof to its top opening, through which it passes to enter another section, and the operation is repeated until it reaches the bottom of the end section C, from which it passes, with the water of condensation, into the discharge or return pipe *c*.

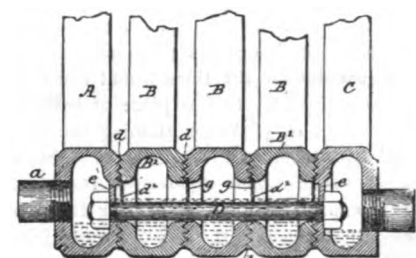


FIG. 1.

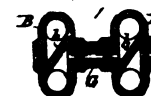


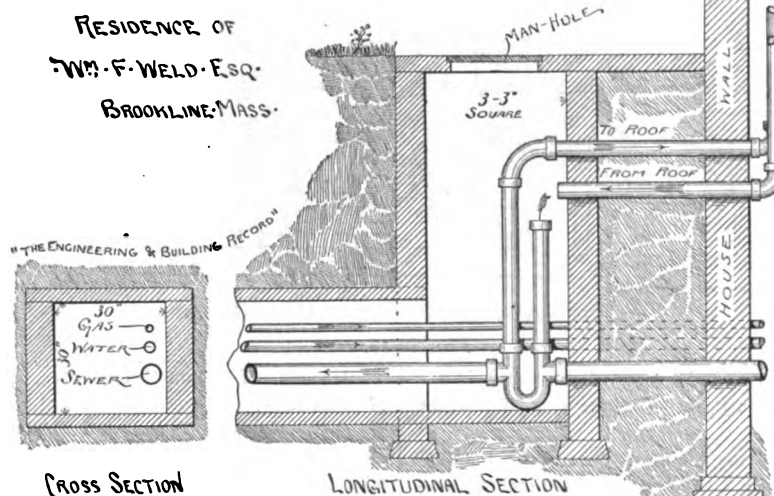
FIG. 2.

To produce a steam-tight joint presenting a large surface for the paint, cement, or substance between the faces of the sections at the point of junction, these faces are provided with a series of concentric grooves *d*, substantially U or V shaped in cross-section and arranged so as to become interlocked when two radiator-sections are brought together in position to be united. These sections may be united together by bolts passing above their bends; but they may be located near the centre of the bearing-surface and to conceal said bolt and dispense with packing under its head and nut, and prevent water or steam from leaking out of the radiator at these points, it is placed entirely within the sections, as shown at D.

To form a rest for the head or nut bolt, the opening in the lower end of the end sections has a partition, formed with said sections, and to permit the water of condensation to escape said partitions have openings above the level of the bolt. To prevent, also, the steam from passing through the openings from the bottom of the section A to the section B, there is placed a pendent gate or steam-seal *g*, made of thin sheet-metal, that is retained between the inner edges of the grooved surfaces.

The washer *G* has concentric grooves *d'* on both sides of its face to become interlocked with the grooves *d* upon the joints of the radiator-sections.

Figure 2 shows the method of joining two sections or elements at the top.



MAN-HOLE AND TUNNEL FOR HOUSE-TRAP AND PIPES OUTSIDE WALL OF BUILDING—

FIGURE 1.

clear, with brick sides and flagged top, manholes being arranged in the lawn through which it can be entered and ventilated. The trap is set in the first manhole close to the house; the size of this shaft being 3'3"x3'3", and the top closed by a flag with cast-iron manhole cover.

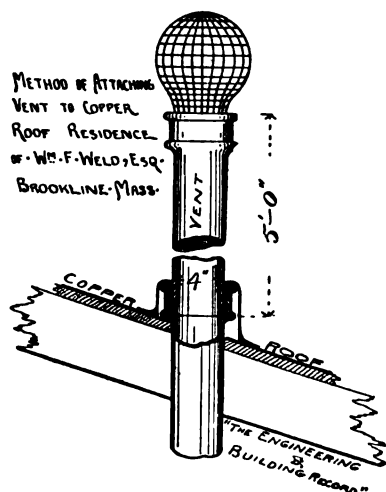


FIG. 2.

The sewer-pipe through the tunnel and grounds is ventilated at this point by a pipe carried up within the building to the highest point of its roof. The sewer, house-drain, and trap are five inches in diameter, and the sewer-vent, just mentioned, and the foot-vent are four inches in diameter. A 4-inch pipe from the position of the foot-vent also extends to the roof alongside the sewer-vent. The arrow on this pipe is shown as though the air-current was down, to supply the foot-vent. This may be so, but the principal object of the pipe is to establish an equalization of pressure between the atmosphere within and without, no matter which way the preponderance may be.

Figure 2 shows how the tops of all the vent-pipes are arranged on the roof. The roof is copper, and it was provided that a hub of the pipe would in every case be so

cross that comes at the top level being closed with a screw-plug, as is also the end that projects 2 feet 6 inches or so above the water. From the top or grease level to the

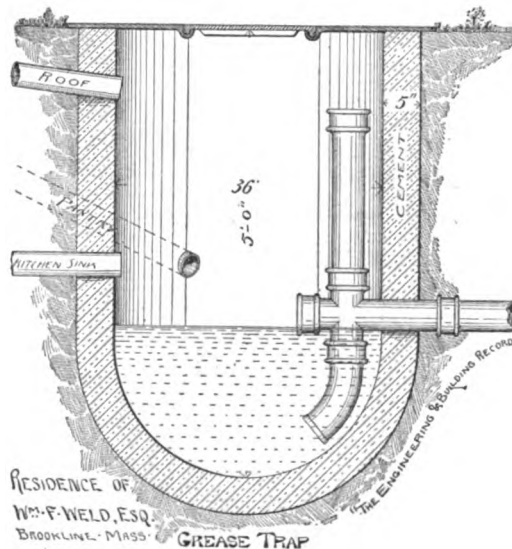


FIG. 3.

edge of the $\frac{1}{2}$ bend under which the clear water flows off is about 15 inches.

(TO BE CONTINUED.)

MONTREAL PLUMBERS TO ORGANIZE A TRAINING SCHOOL.

A WELL attended and representative meeting of the master plumbers of Montreal was held in the rooms of the Montreal Contractors' Association, 99 St. James Street, last week under the following resolution:

Preamble.—The Master Plumbers of Montreal, feeling that the best interests of the general public and themselves will be promoted by an organization having for its object the raising of the standard of the trade and those working at the same,

Resolved, That it is desirable to organize the section of the plumbers, gas, steam, and hot-water fitters in connection with the general association known as the "Montreal Contractors' Association."

Objects.—The objects of the members of the said "section" shall be the promotion, in their fullest and truest sense, of the moral, mental, mechanical, and social welfare of those connected with the different trades, forming or connected with those comprising the membership of the said "section."

FALL OF FIVE DERRICKS AT THE NEW COURT-HOUSE, BOSTON.

ON Wednesday of last week one of the large derricks in use at the new Court-House in Boston fell, dragging down four others with it, and slightly injuring three men of the 150 at work on the building. The derricks are six in number, capable of raising from four to five tons at the end of the boom. The masts are from 70 to 86 feet high and the boom from 55 to 65 feet long.

The mast is formed of a 14x12-inch timber. Where the boom is attached the mast is reinforced by a 12x12-inch

iron is attached to each timber, forming a loop from which a tension rod passes up to the mast-head. On the booms of some of the derricks there are two such loops. A traveler of hard wood slides on the boom and the load is suspended from it.

The four derricks first erected at the northern end of the building were connected together at their heads by 4-inch wire spring-stays, and had guys to adjacent buildings and to posts in the streets. The hoisting-rope on these derricks passed through the foot-block down to a snatch-block situated near the ground, thus making the

transverse pieces were bolted on either side of each wall. For additional support two inclined posts were placed just below the foot-block. The accident happened when a load of some 2 or 3 tons was being raised. The strain on the hoisting-rope and the leverage of the weight on the boom drawing against one of the inclined posts caused the foot-block and cross timbers to be raised off of the brick-work, and the two cross timbers pivoted around on this one post until they got off the wall, the lower transverse pieces tearing out the brick-work on the inside of the wall only, and the whole derrick came down almost vertically, crushing the two cross timbers. The boom was splintered by falling on a granite wall. The shock pulled over four of the other derricks and snapped off a post to which some of the guys were fastened. The mate to this derrick remained in place almost erect, with no damage. Of the other derricks one mast was snapped in two and four booms broken. Had the walls not been built up so high and so close together as to form a sort of enclosure around the four northern derricks, not only would they have been entirely smashed, but the brick-work would have been much more damaged, and probably there would have been more casualties.

As it is the guys got snarled up and let the derricks over quite slowly on the walls, which were damaged only where actually struck and can be repaired with very little labor.

Several of the derricks were idle at the time, so that two days sufficed to rig up the others and very little delay was caused.

The derricks were laid out by Mr. Clough, the architect of the building, and are after the pattern of the Norcross derrick, so called, except that the masts being very long are spliced in the middle and that the traveler has no rollers.

They have proved very strong and useful. But this accident shows the necessity of having a snatch-block under the derrick and independent of the foot-block, so that all the strain of the hoisting rope shall be vertical on the foot of the derrick.

[The foregoing description and illustrations from our Boston correspondent show very clearly the construction of the derricks and the cause of their fall. While the construction of the derricks had nothing to do with their fall, it should be pointed out that they could have been made stronger with less material had a single horizontal strut been set opposite to and at the same height as the boom to transfer the thrust of the boom directly to the truss-rod and thus relieve the mast of all transverse strain. Perhaps this could have been done even better by continuing the boom itself back past the mast until it could receive the support of the truss-rod. This would do away with the two present horizontal struts and the reinforcing timber, as only small splice-plates would be required at the joint in the mast which now comes directly opposite the thrust of the boom and hence in the worst possible place.]

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
November 12.....	23.57	20.60	22.35	29.65	30.26	24.61	32.25

Correspondence.

All correspondents should send us their names and addresses, not necessarily for publication, but as a guarantee of good faith and because it is often necessary to communicate with them for additional information before printing their communications. Anonymous letters will not be noticed.

A TACHOMETER WANTED.

SIR: Can any of your readers state where a current-meter or tachometer can be had (meter for measuring the velocity of water-currents)? ENGINEER.

If our correspondent who signs himself "Engineer," from Reading, Pa., will send us his full name and address, we will reply to his question on steam-heating apparatus of November 5, attached to which is a drawing bearing date of October 30.—ED.

PAINTING ROOF SO THAT DRINKING WATER COLLECTED FROM IT WILL NOT BE INJURED.

STAMFORD, CONN., November 9, 1887.

SIR: My house has a shingle roof from which water is collected in a cistern. This water is used for drinking water.

Can the roof be painted, and, if so, please inform me what paint can be used that will not injure the water?

Yours truly, H. L. UNDERHILL.

[We have used the ordinary iron paint for a tin roof under such circumstances. The paint should not contain lead. Whatever paint is used, the water from the roof for the first two or three days should not be allowed to flow into the cistern, but be run to waste to get rid of oil and sediment.]

THE SENECA FALLS WATER-WORKS.

THE following letter from a prominent citizen of Seneca Falls, regarding the terms on which the town contracted with Mr. Norman for a water-works, is of interest. From this it would seem that if the town did not get much they did not expect much, nor have they been inclined to spend much money:

SENECA FALLS, N. Y., November 14, 1887.

SIR: The water-works project had previously been discussed and voted upon in this town until the citizens were opposed to any contract or option at all. So that these works were built at the entire risk of the builder. The only condition was: he was granted permission to lay his mains in the streets, and required to make the road-bed as good as he found it. There have been no hydrants taken by the town, although a public sentiment was gradually working up in favor of taking hydrants in certain places.

A few of the citizens have distrusted the efficiency of the cement pipes, and suspected that the whole thing was a cheap job intended for sale. Suspicion was strengthened by the fact that the place of water-supply is not the best, although it is the cheapest. But the general sentiment is one of confidence in the man and sympathy with him in his loss.

PREVENTION OF FIRE IN THEATRES AND PUBLIC BUILDINGS.

WE are asked by the city engineer of an English city as to what regulations exist in New York or other American cities relative to precautions adopted for prevention of fires in theatres and public buildings. He states it is reported that in some States automatic sprinklers are required by law to be provided, and would like information on the whole question as to the practice in the United States. We shall be obliged for any data or copies of regulations our readers can furnish.

THE IMPORTANCE OF WETTING BRICK BEFORE LAYING.

SHARPSVILLE, MERCER COUNTY, PA., }
November 14, 1887.

SIR: Editorially remarking upon "The Fall of the Parochial School Building in Harlem," in your issue of October 22, you say, "The causes of the disaster are sufficiently set forth" in the report of the Superintendent

of the Building Bureau, and quote from that report six specifications charging, respectively, use of poor or insufficient material, faulty architectural construction, and reckless, and every way bad, practice in building.

The first of these specifications charges that the mortar, used in the building in question, was of but "medium" quality. Mr. Martin, Inspector of the Harlem District, has, since the fall of the school-house, reported the mortar to have been "first rate" in quality. But, arguing from the fact that you could nowhere find any mass of fallen brick held together by the mortar (the brick having fallen "clean," as you state the matter), you assert, "medium is a very mild term to apply to this mortar," and you leave your reader to infer that the mortar was not even of moderately good quality.

You do not say that you actually inspected the mortar (of which you might have found a sufficient quantity in the mixing beds, no doubt). If you did so, you can, presumably, state the proportions of the mixture, and if the mortar was actually "poor" (Mr. Martin to the contrary notwithstanding), that fact is, of course, important in the case. But the simple facts that the bricks were not cemented together by the mortar, and that (therefore) they fell "clean," are not sufficient evidence that the mortar was not of "first rate" quality.

Mortar made of the best possible admixture of good lime and sharp sand is, in cementing effect, of but little more value than mud, in cases where the bricks "laid" in it are (practically) perfectly dry when laid.

A common brick, which when "dry" weighs 4½ pounds (seventy-two ounces), if kept thoroughly wetted for an hour or two will absorb about twelve ounces, or about seventeen per cent. of its own weight of water. Such brick, laid in wall without previous thorough wetting, will speedily absorb practically all the moisture of the mortar, leaving the "mortar" but little, and sometimes not any, cementing virtue. If a wall constructed, as aforesaid, of dry brick, be thrown down, the bricks will fall "clean," evidences of good cementing will be rare. I do not know what is the general practice in and about New York in the matter of wetting brick as preliminary to laying them; but I do know that this treatment (of wetting), so necessary to proper results in cases of work done in dry weather, is in most parts of the country largely, if not entirely, omitted or shirked.

J. M. GOODWIN, Mem. Am. Soc. C. E.

[In reply to our correspondent, we would say that by the use of the word "clean," we meant all that it could imply in that connection—namely, that the fallen bricks were not merely separate from each other, but that no mortar adhered to them, which we considered a sufficient indication of its character. We have, in freezing weather, had brick laid without wetting and with fairly satisfactory results, though, of course, in that case there should be more water in the mortar. Without further experiment we are inclined to doubt whether really good mortar would merely, by being used with dry bricks, be as entirely deprived of its adhesive properties as was the case here.

We confess, however, that we had not in this instance thought of any possible neglect in wetting the brick before laying, as it is the universal custom in this city, being specially required by the building law, and as water must always be had for mixing the mortar, and is usually obtained through a hose from a hydrant or street-washer, the additional labor of wetting the bricks with the hose is so slight as to be seldom, if ever, neglected.

We are glad that our correspondent should have called attention to this important matter, doubtless, as he says, often in many places "omitted or shirked," and from early experiments of our own we can corroborate what he says about the absorption of water by dry bricks. Bricks, however, should not be saturated, as in that case they do not "suck on" to the mortar, and are apt to slip when laid; also, the excess of moisture softens the skin of the bricklayer's fingers so that they soon get worn and sore. We should be glad to hear from others who may have had experience in laying bricks without wetting, from cold weather or other causes, and in this connection the result of the experiments on the addition of salt to cement when used in freezing weather, which we give in another column, may be of interest.]

THE LESSON OF THE SENECA FALLS AND FRANKLIN STAND-PIPE DISASTER.

SIR: The fall of two water-towers built by a contracting engineer should call the attention of corporations or individuals who intend erecting works of any kind to the necessity for skilled supervision which has no pecuniary interest in the profits of the contractor.

A habit has grown up by and through contractors', who are anxious to take greater or less risks for the sake of economy, offering to advance a certain amount of capital and do their own engineering. It is not alone the ignorant, and possibly sometimes venal, selectman or village trustee that finds himself unable to resist the twofold bait, but

large railroad corporations are often guilty of sacrificing, to a greater or less extent, the interests of their stockholders by virtually making their contractor their chief engineer.

The village magnate, possibly a small lawyer or worthily engaged in the retail sale of tape or sausage, may be pardoned for not seeing through the declamations of the would-be contractor who, it may be, has had some small practice in his profession or has an engineer associated with him, and may believe that he really does know more than all the engineers put together (he surely will not find any engineer claiming so much); or that engineers are a nuisance and unnecessary expense on work where there is an intelligent contractor who has a large pecuniary interest, say one-half the expected profits, in the success of the work.

But any business man who allowed an agent to be the sole auditor of the accounts presented for his expenditures would meet small sympathy for his losses. Nor would, in general, an agent be employed who urged as a condition of employment the privilege of being such sole auditor. The corporation which allows a contractor to take its work on his own specifications, to be executed under his own supervision, seems about as wise as the man who gave his debtor the note just signed—so that he could remember when it became due.

While the practice of unwatched contracting in all branches of construction is far too prevalent in this country for either stability of structure or safety of life, it is exhibited in its worst forms in the construction of water-works for small places, where constructing firms, with their command of capital, approach towns and villages with offers to build and operate water-works on terms which often read like the bargain of the horseshoer, only there is no limit to the nails. While much of the work done by these firms is of good quality, some of it is undoubtedly of very poor material and design, and usually the intention is to derive the maximum revenue from the minimum supply of water.

If you, Mr. Editor, agree with me that supervising work, in the cheapness of which the supervisor has a direct pecuniary interest, brings too heavy a strain on human nature, and that the proposition to do so is almost *prima facie* evidence of an intention to take undue advantage, I hope you will give the influence of your paper, already noted for the good work it has done in this direction, to the thorough exposure and condemnation of the practice. C. E.

LONDON CORRESPONDENCE.

A Tramway Locomotive—Management of English Technical Schools—Boiler Inspection—Lighting Buoys by Gas.

A NEW form of tramway engine has lately been tried on the West Brighton and Shoreham Tramway system. It is from the design of Mr. Alfred Greig, of Leeds, and built by Aveling & Porter, Rochester. The special feature in the engine is that the cylinders and working parts generally surmount the boiler, the object being to minimize the introduction of dust, mud, etc., which of course obtains very largely with the usual type engine carrying the working parts below the boiler, to the shortening of life in the working parts. The dimensions of the engine are 11'6"x5'8"x9'6", carrying a locomotive type of boiler, with working pressure of 180 pounds. There are two 5½-inch cylinders with 10-inch stroke, and the connection with the driving axles is by spur gearing: the power is taken from a pinion on the crank-shaft to an intermediate wheel, geared into other wheels, thence to the axles. The engine has an automatic brake to shut off steam directly a speed of nine miles is attained. A Blackman propeller, driven by an auxiliary engine, passes a current of air over the tubes of a condenser, through which exhaust-steam is passed. The engine is stated to work very satisfactorily.

The value of schools for technical education is being very generally recognized. Professor Sylvanus P. Thompson, speaking at St. Pancras a few days since, drew a very unfavorable comparison between the technical schools of England as against those of Germany and other countries. He expressed an opinion that in the present state of deficient technical education Englishmen ran a great risk of having the bread taken out of their mouths by foreign workmen. The professor might have preached also on another text, showing that when good technical schools are instituted, it is well to expend a *fair proportion* of the total expenditures on the teachers, as against the building and administrative staff. In at least one branch, under the City Guild's Institute, the remuneration is absurd and totally inadequate; so low indeed as 4½d. (9 cents) per hour.

The English Board of Trade have prepared a bill which was read a first time during last session giving the neces-

sary powers for the supervision of boilers. It has long been admitted that such supervision is necessary, but it is difficult to see why a clause is inserted exempting boilers in vessels classed as Lloyd's or having passenger certificates. It is just as necessary, indeed if not more so, that such boilers should be subjected to inspection as those that are on land.

A correspondent of the *Times* gives the following information respecting the manufacture and supply of gas for lighting buoys in the various channels, under the system of Pintsch's Patent Lighting Co. The gas used is made from once refined paraffine subjected to special treatment and purification when made. It has an illuminating power of 45 candles when burnt in the London standard burner. The cost of the gas is from 8s. to 11s. per thousand cubic feet. In its manufacture for the purpose of buoy work, a small gas-works at some accessible distance in the locality is necessary. The oil is vaporized in cast-iron retorts and carried off as gas to a small gasometer. The necessary superficial area for the purpose is about 40x16 feet. From the gas-holder it is forced into cylindrical holders at a pressure of 150 pounds to the square inch. It is forced into strong cylindrical holders of the capacity of 3,700 feet of gas compressed into a cubic space of 370 feet, and served into the holders at a pressure of 150 pounds. Two of these holders are conveyed from the gas-works to the buoy which requires replenishing, and the gas is served thence into the buoy's receiver by an automatic regulator, the outflow of the gas from the buoy being controlled so that it issues at the burner at $\frac{1}{16}$ water column pressure.

THE CHICAGO DRAINAGE COMMISSION.

CHICAGO, ILL., November 5, 1887.

To Hon. John A. Roche, Mayor.—Sir: In accordance with your instructions, the work of the Drainage and Water-Supply Commission is now closed. The interpretation that your honor has deemed proper to place upon the action of the Council of January 27, 1886, under which the work was undertaken, is that the object of the same has now been practically accomplished—viz., the determination of the best general plan of future sewage disposal for the city of Chicago, it being assumed that the collection of further data and the preparation of details should be postponed until it has been decided to execute the problem.

The interpretation placed upon the same by the preceding administration, which has guided and limited the scope of the investigation, was that all phases of the subject should be investigated not only in their general aspects, but in sufficient detail to render it possible to give close comparative costs of the different schemes of sewage disposal which were being urged, and that the reasons for accepting or rejecting any plan should be set forth in detail, the work marked out being not merely affirmative, but negative, to the extent which should be necessary to finally clear the ground of all incumbrance. Hence the study of these projects has been prosecuted on a scale to enable the commission to "report on the whole matter committed to it in the most full and comprehensive manner," which are the terms of the resolution.

While satisfied with the conclusions presented in our preliminary report of January, 1887, and while without hesitation we recommended the disposal of the sewage into the Mississippi Valley, diluted with a large amount of water from Lake Michigan, and the taking of the lake water for domestic consumption at points opposite the city; while we are satisfied as to the advisability of diverting the flood water of the Desplaines River as a part of the plan of future sewage disposal, as set forth in a supplementary report of July, 1887, we are not prepared to make a final report in obedience to the action of the council for reasons which we respectfully submit for your consideration.

And we cannot refrain from expressing our decided conviction that when the present employees go out they will carry with them a large percentage of the results thus far gained greatly to the loss of the city, because much of the matter will have to be taken up *de novo*, which can only be prevented by having them complete their unfinished tasks.

To close the investigation at the present time will prejudice our cause in all the towns and cities which are affected by our sewage disposal or are interested in a navigable waterway to the lakes. Chicago will be weak against

opposition in Congress this winter, and will not be able to present a technical case before the board of United States engineers likely to be appointed, and will be in danger of failing to secure needed State legislation. In addition to this the sanitary needs of the city are pressing, and will be urgent before the remedy can be applied. We are convinced that we would be culpable if we acquiesce in the abandonment of the investigation without expressing ourselves with the strongest possible terms in the negative.

The subjects of the most vital importance, requiring further investigation in order to fulfill the objects for which the commission was created, are as follows: The pollution of the main waterway and the necessary dilution which should be secured. The physical effects upon the Desplaines and Illinois Rivers of turning a large quantity of water from the lake into their beds in addition to that already carried. The study of the velocity of water in the proposed channels as to the economic construction of the same, and its effect upon navigation. Finishing all maps and plans and the compilation of all data and their presentation in a systematic report for permanent use.

We are of the opinion that these questions could be answered by the end of next spring with the expenditure of not more than \$20,000 for chemical analysis, salaries of some additional men and the present force, which consists of Mr. L. E. Cooley, Principal Assistant Engineer, and Messrs. Johnston, Feind, Ericson, and Lydon, assistants, of whose industry and ability we desire to make special mention. Respectfully submitted,

S. G. ARTINGSTALL, RUDOLPH HERING,
BENEZETTE WILLIAMS, Chief Engineer.
Consulting Engineers.

THE ENGINEERS' CLUB OF ST. LOUIS.

The club met November 20, President Potter in the chair, W. H. Bryan, Secretary, nineteen members and one visitor present. The Executive Committee submitted the following report on programme, which was adopted:

ST. LOUIS, November 2, 1887.

GENTLEMEN: Your executive committee beg leave to submit the following programme of the club's work for the coming year. Meetings have been arranged for the first and third Wednesdays of each month up to June next. It is not expected that this plan can be rigidly adhered to, but it will serve as a basis to work upon, and will be followed as closely as circumstances permit:

November 2.—Charles E. Jones, "Steam-Heating at Washington University."

November 16.—Prof. J. B. Johnson, "Testing the Strength of Engineering Materials."

December 7.—Annual meeting.—P. M. Bruner, "The Action of Frost on Concrete Work."

December 21.—Isaac A. Smith, "Rapid Railway Embankment Construction."

January 4.—Charles H. Ledlie, "Construction of Dam and Reservoir at Athens, Ga.," Charles W. Bryan, "Railway Bridge Designing."

January 18.—Carl Gayler, "Floors of Street Bridges"; N. W. Eayrs, "The Improvement of Nantucket Harbor, Mass."

February 1.—Professor F. E. Nipher, "Graphical Solution of the Action of the Series Dynamo"; B. F. Crow, "Constructive Accounts."

February 15.—Robert Moore, "Sizes of Railroad Culverts"; O. L. L. Petitdidier, "Practical Notes on Masonry and Stone Laying."

March 7.—Professor H. B. Gale, "The Transmission of Power by Belting"; Samuel F. Burnet, "Cement and Mortar."

March 21.—Professor W. B. Potter, "St. Louis Water-Supply."

April 4.—S. Bent Russell, "Thickness of Water Pipes"; H. A. Wheeler [subject not yet announced].

April 18.—Professor C. M. Woodward, "Gas Producers"; Lewis Stockett, "A Well-Ventilated Mine."

May 2.—Colonel E. D. Meier, "Standards of Boiler Efficiency"; Charles F. White, "The Failure of Firm-nich Boiler."

May 16.—R. E. McMath, "The Waterway Between the Lakes and the Mississippi River."

June 6.—M. L. Holman, "The Temporary Low Service Pumping Plant at St. Louis."

Partial promises have been made of other papers on topics of interest. These will be presented as opportunity occurs and due notice given.

Six applications for membership were received.

Professor Johnson read a communication from the Board of Managers of the Association of Engineering Societies, on the subject of a closer union between the societies now in the association and others. The consideration of this paper was made a special order for the next meeting, November 16.

Mr. Charles E. Jones then read a paper on "Steam-Heating at Washington University, and Experience

Underground Pipes." The history of the system in use was given with details of its construction and the work done. It was shown that the boilers were regularly doing double the duty which was originally expected of them. The evaporative efficiency did not seem to be reduced when the boilers were forced in this manner. Great efforts had been made to reduce the smoke and many devices had been tested. All had failed on account of the excessive duty required of the boilers. The underground pipes had failed after three years of service from external corrosion due to the accidental admission of moisture to the conduits. New pipes had been laid recently and the construction of the new conduit was shown.

Professors Woodward, Potter, Gale, and Messrs. Bryan and Sharman took part in the discussion. Mr. Jones added that a new stack had just been erected, which had increased the draft sufficiently to permit the introduction of a small amount of air above the grates. This had resulted in an appreciable reduction of the smoke.

WILLIAM H. BRYAN, Secretary.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The eighth annual meeting (XVIIIth) of the American Society of Mechanical Engineers will be held in the city of Philadelphia, Pa., beginning Monday evening, November 28, and ending Friday, December 2. This has been chosen by the council under the rules, to suit the convenience of those who might wish to visit Eastern homes for Thanksgiving, and who can thus attend the sessions on the same trip. The opening session is put down for Monday to admit of the most profitable use of time.

The business sessions of the convention will be held in Parlor C, of the Continental Hotel, corner Ninth and Chestnut Streets. The headquarters and secretary's office will be at Room No. 27 on the first floor.

The Continental will give special rates to members, as follows: \$2.50 and \$3 per day, excepting on first and second floors, where the rates will be \$4 per day. Rooms with bath will be charged for at \$1 per day additional, whether occupied by one or two persons. Fires will be fifty cents per day. It is hoped for the sake of social intercourse and professional profit that as many as possible will stop at this house.

The programme of sessions is as follows: Monday evening, November 28, at 8 P. M., first session, president's annual address.

Second day, Tuesday, November 29, at 10 A. M., business session, reports of committees and general administrative detail. After these the professional papers will be taken up. The afternoon will be left free for members to visit different manufacturing establishments who have extended invitations.

In the evening, at 8 P. M., third session for professional papers and discussion.

Third day, Wednesday, November 30, at 10 A. M., fourth session for professional papers and discussion. Fifth and concluding session at 2:30 P. M. These sessions will be in Parlor C, of the Continental Hotel.

On Wednesday evening, a reception is tendered to the society at the Academy of Fine Arts, being the occasion of a private or first view of a special collection of portraits, together with the regular pictures of the academy.

Fourth day, Thursday, December 1, excursion by special train to Bethlehem, Pa., leaving by P. & R. R. R. at 9:15 A. M., returning to reach the hotel at 5 P. M. This visit will be to the new plant of the Bethlehem Iron Co.; also to the Lehigh University and to the Lehigh Zinc Works. In the evening a complimentary dinner will be given to the members by citizens of Philadelphia.

Invitations have been received from the following establishments and institutions to visit them during the sessions of the society:

Bethlehem Iron Company, Bethlehem; Lehigh Zinc and Iron Company, Bethlehem; Pennsylvania Steel Company, Steelton; Henry Disston & Sons, Tacony; Baldwin Locomotive-Works, City; Bement, Miles & Co., City; William Cramp & Sons Ship and Engine Building Company, City; I. P. Morris & Co., City; William Sellers & Co., City; Southwark Foundry and Machine Company, City; Williamson Bros., City; Kensington Engine-Works, City; Otto Gas-Engine Works, City; Pennsylvania Museum and School of Industrial Art, City.

The following papers are to be presented and discussed at this meeting:

Lewis F. Lyne: "The Use of Kerosene Oil in Steam-Boilers."

Henry I. Snell: "Method of Ventilating and Heating Office and Warehouse."

John E. Sweet: "A New Principle in Piston Packing."

R. H. Thurston: "Internal Friction of Non-Condensing Engines."

John J. Grant: "The Milling-Machine as a Substitute for the Planer."

Henry I. Snell: "Centrifugal Fan-Blowers and the Power to Drive them."

John Coffin: "Steel Car Axles."

Oberlin Smith: "Power Press Problems."
 Frank Van Vleck: "Standard Section Lining."
 Percy A. Sanguinetti: "Divergencies in Flange Diameters in Pumps, etc."
 William O. Webber: "Centrifugal Pump Efficiencies."
 Gaetano Lanza: "Friction of Toothed Gearing."
 Jerome Sondericker: "How to Test Strength of Cements."
 H. deB. Parsons: "Influence of Sugar upon Cements."
 James M. Dodge: "New Method of Stocking and Re-loading Coal."
 E. C. Felton: "Results Obtained from Steel Tested Shortly After Rolling."
 O. C. Woolson: "Road-bed for Railroad Bridge Structures."

Subjects and Queries will also be presented for the Topical discussions, which have proved so interesting and profitable at the recent meetings. The Secretary will be glad to receive any written discussion of any of them from members who cannot attend the meeting. Such communications will be read at the meeting as part of its proceedings.

Special railroad rates have been secured for this meeting under the certificate plan. By this scheme the members pay full fare coming to the meeting and have a certificate of such payment signed at the starting point. On the presentation of such certificate, indorsed by the Secretary, at a Philadelphia ticket-office, they receive their return-ticket for one-third the regular rate. Members buying tickets west of Pittsburg and Wheeling will obtain their certificates from the ticket-agent at the starting points. Members starting east of those points will receive the certificates and instructions from F. R. Hutton, Secretary, 280 Broadway, New York.

THE FALL OF AN L-ROAD ERECTING-CRANE.

THE traveling crane used by the Pencoyd Bridge Company in erecting their elevated railroad work on Flatbush Avenue, Brooklyn, fell to the ground early on Wednesday morning last, with the two longitudinal girders on which it rested.

The accident seems to have been due entirely to a lack of care or skill on the part of the foreman in charge of the work in two particulars. In the first place, the crane was used while its front or bearing end was on the middle of a span instead of over a transverse girder, as it should have been; and second, the centre boom, some sixty feet long, was used to lift a heavy weight at some distance to one side of the structure, which brought most of the weight of both crane and load on the centre of one of the two inner girders on which the crane traveled. It was a case of "more haste less speed." The foreman is understood to have been trying that day to make a record, and made a wreck instead. *Festina lente.*

The platform of the crane broke in two over the transverse girder between its front and rear bearings, so that the boiler on its after part fortunately did not fall, and its explosion was not added to the general ruin.

Perhaps if the front of the crane had been wide enough to get a bearing on the two outer girders as well the accident might not have occurred. Another contributing cause may have been the lack of lateral bracing between the longitudinal girders on which the crane traveled. This cannot well be put in permanently until after the crane has passed, and the temporary wooden substitutes are not always reliable.

The fractured metal of both crane and girders seemed of excellent quality.

The crane was designed by Mr. C. C. Schneider, Mem. Am. Soc. C. E., and Chief Engineer of the Pencoyd Bridge Company, and was a very complete affair, having three booms and so arranged as to erect all parts of the structure.

We have for some time contemplated giving our readers a full description of it, such as we have already given of the erecting-crane used by the Phoenix Bridge Company on the Kings County Elevated Road, and expect to do so in our next issue.

Fortunately, as has been the case in all the accidents we have chronicled during the last few weeks, no one was seriously hurt, although there was the usual narrow escape, a crowded horse-car having barely passed under the crane before it fell.

We trust this series of instructive accidents will not culminate in some frightful tragedy; but the good fortune that has hitherto attended them cannot be expected to continue, and if THE ENGINEERING AND BUILDING RECORD has any heedless or ignorant readers, let them be warned to be wise in time.

THE SENECA FALLS STAND-PIPE.

Mr. JOHN F. WARD, a civil engineer, of Jersey City, who has had large experience in water-works construction, in a communication regarding the failure of the stand-pipe at Seneca Falls, suggests, as a possible solution of the failure, that, when the tank was being erected, there were no proper precautions taken to prevent the straining of some of the sheets by the action of the wind. In putting up the first four or five courses of these sheets, which were presumably about nine feet long by five feet high, they were doubtless held in place by temporary bolts, and the action of the wind at night might cause a fracture that would not be noticed by the workmen the next day. He recalls a similar experience with a tank some years ago, in Cincinnati, due to this cause. If this is so it is only another argument for the necessity of skilled supervision of the erection of structures of this character, and especially when steel is used.

OUR correspondent in Springfield sends the following further information regarding this stand-pipe:

"Regarding the failure of stand-pipe at Seneca Falls, Mr. R. F. Hawkins, who built it, informs me that the construction was carried out in accordance with specifications furnished by Mr. Norman, the work being directly in charge of a Mr. Cunningham, who acted as engineer for Mr. Norman. Mr. Hawkins informs me further that the failure of the stand-pipe was probably due to the giving away of the bottom plate near the outlet-pipe, which he thinks was caused by the foundation."

THE ENGINEERS' CLUB OF PHILADELPHIA.

THE club met on November 5, President T. M. Cleemann in the chair, Howard Murphy, Secretary and Treasurer; seventeen members present.

The following were elected active members of the club: Messrs. Henry I. Snell, Henry B. Seaman, Frank Cooper, Arthur H. Wood, Erwin Graves, I. H. Wainwright, and Fred. J. Amweg.

The Secretary called attention to the fact that the 17th of December of this year would be the tenth anniversary of the organization of the club, and recommended that it be observed by the holding of a reception in the club house on that evening. After some discussion the following resolution, offered by Mr. John T. Boyd, was unanimously adopted:

Resolved, That a committee, with power to act, be appointed to take charge of a decennial anniversary reception, to be held in club house on December 17, 1887, at 8 o'clock P. M.; said committee to consist of as many members as chair may decide, who shall issue cards of invitation, given on request of members, the latter to be entitled to invite not exceeding three members of the engineering or architectural professions, all members being requested to subscribe two dollars by notice sent by the secretary, and that such other invitations may be issued as the committee shall deem proper and desirable.

Mr. Boyd was unable to serve on the committee, which the President appointed as follows: Percival Roberts, Jr., Chairman; E. V. d'Inville, Prof. L. M. Haupt, C. G. Darrach, Frederick Graff.

Mr. C. G. Darrach presented a paper upon "Boiler Specifications," which was discussed at length by Messrs. John T. Boyd, Charles T. Thompson, A. Marichal, J. E. Codman and others. At a late hour it was decided that the discussion be continued, and that such copies of the specifications as the authors could supply be sent to such members as would probably take part in the discussion.

THE ENGINEERS' CLUB OF KANSAS CITY.

A REGULAR meeting of the Engineers' Club of Kansas City was held November 7. There were present Messrs. W. B. Knight, A. J. Mason, E. B. Kay, A. E. Swain, C. E. Taylor, S. A. Mitchell, T. F. Wynne, E. W. Stern, Clift Wise, Kenneth Allen, Secretary, and five visitors. Mr. Wynkoop Kiersted was elected a member.

The Secretary read a letter from the Executive Board of the Council of Engineering Societies inviting co-operation.

The President was directed to appoint a committee of three to act in conjunction with the other committees of the Council.

The President appointed Messrs. Chanute, Breithaupt, and Wise. Victor M. Witmer was proposed by E. B. Kay as associate member. Mr. Wynkoop Kiersted read a paper on "Water-Supply and its Development for Small Cities in the West," which was then discussed.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS.

A MEETING for the reading and discussion of papers only was held Wednesday evening, November 16, the President, William E. Worthen, in the chair, and, in the absence of the Secretary, the papers were read by Mr. Theodore Cooper. The first paper was on "Experiments Upon Z-Iron Columns," by C. L. Strobel, M. Am. Soc. C. E. The next paper was by A. P. Boller, M. Am. Soc. C. E., on "Test of a Wrought-Iron Double-Track Floor Beam." A chart illustrating the different wire gauges in use was then exhibited and explained by S. S. Wheeler, Jun. Am. Soc. C. E. Abstracts of these papers and of the interesting discussions which follow them will, for lack of space, have to be deferred to our next issue.

BOSTON SOCIETY OF CIVIL ENGINEERS.

THE regular monthly meeting of the Boston Society was called to order at their rooms November 16, by Vice-President F. P. Stearns. After the regular business had been attended to the members were favored by an account of the plant of the Boston Heating Company, given by A. V. Abbot, Chief Engineer of the National Superheated Water Company, of New York. The remarks were illustrated with a small section of the pipes and fittings as laid through the streets and houses. There were 58 members and 26 visitors present.

THE EFFECT OF FROST ON CEMENT RESISTED BY SALT.

PH. DELAHAYE, in the *Revue Industrielle* of November 3, describes some experiments recently made in Germany, on the action of cold on hydraulic cements. The stones used were 2½-inch cubes. Some of the stones were joined with cement mixed with pure water, others with cement mixed with water which contained two per cent. of salt, and others again with cement mixed with water containing eight per cent. of salt. While the cement was still fresh the stones were placed out of doors, and left exposed twenty-one days in a cold of 20° to 32° Fah., after which the stones were kept in a warm room for a period seven days. At the end of this time it was found that the cement mixed with pure water was completely disintegrated and had no holding power. The cement containing two per cent. of salt was in a better condition, but not good. Whereas the cement the water of which had had eight per cent. of salt had not suffered in the least.

JAMES B. SNIFFEN.

THE many friends of Mr. James B. Sniffen, for many years connected with The Meyer-Sniffen Co., Limited, will be pained to hear of his death, which occurred on the 17th inst., at Brooklyn, N. Y.; a malignant attack of malarial fever being the cause. He is to be buried to-day at White Plains, N. Y.

PERSONAL.

CAPTAIN L. E. CAMPBELL, U. S. A., has been transferred from Fort Leavenworth, Kan., to Denver, Col.

COL. RUFUS SEXTON, Asst. Quartermaster-General, U. S. A., now stationed at Louisville, Ky., will shortly retire from active duty and settle at Germantown, Pa.

LIEUT.-COL. HENRY C. HODGES, Deputy Quartermaster-General, U. S. A., in charge of General Depot of Quartermaster's Department at New York, has been ordered to relieve Col. Rufus Sexton at Louisville, Ky.

DR. WILLIAM O'GORMAN, a prominent surgeon, died in Newark, N. J., recently, aged sixty-three years. He was born in Ireland and graduated there, but came to this country in 1849. He was Chief of New Jersey Medical staff during the war.

D. W. C. PERRY, Chief Engineer of the Kansas City and Pacific Railroad, spent last week in New York. He reports that his company has constructed about 100 miles of line in South-eastern Kansas, from the line of the Indian Territory north through Parsons and toward Paoli.

MR. J. H. STRIEDINGER, M. Am. Soc. C. E., has recently returned from New Granada, in Central America, where he has been engaged at railroad work and mining. His return is caused by the outbreak of a revolution. These revolutions do not facilitate engineering operations.

THOMAS C. BATES, a veteran railroad builder, died at Rochester, N. Y., on the 10th inst., aged seventy-five years. The deceased was actively engaged before the war in railroad construction in the South and he was chiefly instrumental in building all the railroads in Louisiana. He was a native of New Jersey.

R. E. BRIGGS, late Chief Engineer of the Mexican Central Railroad, has just completed the location of a new line of railway between Denver and Leadville, which will do away with the famous Georgetown Loop. The new line has six hundred degrees less curvature and is one and one-half miles shorter than the old line.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

ON the evening of Tuesday, 15th inst., the Engineers' Society of Western Pennsylvania held their regular monthly meeting. The discussion on Mr. Ramsey's paper of the October meeting was continued by Messrs. T. P. Roberts, E. Koch, C. P. Buchanan, Jacob Reese, G. W. G. Ferris, Professor F. C. Phillips, and J. A. Brashear. Mr. C. P. Buchanan read a paper on some tests of steel beams which he has recently made in the interests of the P. C. & St. L. R'y Co. A committee was appointed to investigate and report upon the practicability of above or below grade crossings for railways entering the cities of Pittsburgh and Allegheny.

THE Arkansas Society of Engineers, Architects, and Surveyors organized an association on November 11, at Little Rock after a drive about the city. They enjoyed a banquet tendered them by the local committee and citizens of Little Rock. The local committee was: T. Harding, Chairman; Frank W. Gibb, Secretary; F. J. H. Rickon, B. J. Barlett, J. W. Cheek, J. H. Haney, James A. Martin, Henry G. Martin.

THE Connecticut Civil Engineers' Association held its quarterly meeting in Hartford, November 9. In the morning the members visited the new Commerce Street bridge and at noon took dinner at the United States Hotel. At the afternoon session a paper on the use of hydrants was read by C. E. Chandler, of Norwich, president of the association. Discussion of the paper followed and of the comparative merits and economy of hydrants with one or more nozzles on one branch and their effectiveness in case of fire. After this discussion the members visited the Asylum Street bridge and other points of interest.

MECHANICS' FAIR, BOSTON, MASS.
(Special Correspondence.)

THE Sixteenth Triennial Exhibition by the Massachusetts Charitable Mechanics' Association opened on the 17th of September and will close on the 26th of November. The fair is held in the Exhibition Building on Huntington Avenue and is easily accessible from all parts of the city. Thus far the fair has been well attended and is deemed a success. The railroads run excursion trains from the cities and towns in the vicinity, as well as from outlying States. Music is furnished during the day and evening. The building is open from 9 A. M. to 10 P. M.

While we notice many prominent New England manufacturers have not availed themselves of the opportunity of exhibiting their various products, there is a good general exhibit.

Among the exhibitors are:

The Jarvis Manufacturing Company, of Boston, showing feed-water heaters, improved power-pumps, and Armington & Sims engines in active operation, the main steam-pipes being covered by Gale & Childs, 134 Pearl Street, Boston, the New England agents for the magnesia sectional pipe-covering. The Hancock Inspirator Company, injectors and inspirators. George T. McLauthlin & Co., engines, elevators, boilers, etc. The Clinton Wire Cloth Co., of Clinton, Mass., wire netting and lathing for fire-proofing purposes. The New England Anderson Pressed Brick Co. show plain and ornamental building brick, trimmings, etc. The Gurney Hot-Water Heating Co. show hot-water heating apparatus for dwellings; visitors can see the apparatus in operation in the basement. The Gorton & Lidgerwood Co., of New York, house-heating boilers. The New York Exhaust Ventilating Co., ex-

haust-wheels for ventilating purposes. S. L. Holt & Co., Boston, portable and stationary steam-engines. The Wainwright Manufacturing Co., Boston, make a good exhibit of feed-water heaters, filters, four-way valves, corrugated tubing, expansion-joints, radiators, etc. George F. Holt, steam-engines and boilers. B. S. Williams & Co., the Manvel windmill. William Allen & Sons, Worcester, house-heating boilers. The Monson Slate Co., of Maine., show slate and slate products. B. F. Sturtevant, of Jamaica Plain, Boston, steam-fan. C. P. Coburn & Co., steam-pipe covering. John Post, Jr., & Co., steam-engines and centrifugal pumps. George G. Stillman, the Spencer automatic damper regulator. The Waterhouse Electric and Manufacturing Co. have a display of electric dynamos and lamps. Tyler Bros., of Boston, iron and steam boiler-tubes. The Dean Steam Pump Co., of Holyoke, have a large display of steam pumping machinery. Locke Bros., of Salem, Mass., show their steam-damper regulator. Henry W. Peabody & Co. exhibit the Hawkins hot-air system of heating and ventilation; also the Lowcock improved fuel economizer. The Adamanta Manufacturing Co. show their adamanta varnish gum, varnolio, an oil varnish manufactured from the same material for painters' use; also their adamanta enamel for iron pipe and adamanta rubber substitute specially adapted for electrical purposes. The Sanitas Manufacturing Co., plumbers' appliances. The Mason Regulator Co., governors, reducing-valves, etc. The Whittier Machine Co., of Boston, show valves for water, steam, and gas; they also have a George F. Blake Manufacturing Co.'s pump, run by a Daft electric motor, pumping pressure for the elevator; the motor is run by a Daft dynamo, run by the Ames' oil engine; the elevator is in constant use in the building. The Shipman Engine Co., of Boston, show an automatic steam-engine, using kerosene for fuel; consumption, a half a gallon an hour per horsepower; a three-horse-power engine running 33 16-candle-power lights from a Thomson-Houston dynamo; speed of engine, 390, and dynamo, 1,600 revolutions per minute; also running 5 2,000-candle-power arc-lights from a Waterhouse dynamo. The Washburn & Moen Manufacturing Co. show samples of wire of their own manufacture. The Bacon Boiler and Furnace Co., furnace for house-heating purposes. Sawyer & Blake, with the Edison Electric Illuminating Co., electric-motors in all sections. The Ashton Valve Co., safety-valves for steam-boilers. A. Hun Berry shows ventilating-fans and a lid-back engine. The Jones Manufacturing Co. show the Gem water-filter for household purposes. Alfred J. Gilderson also shows water-filters attached to faucets. The Seibert Cylinder Oil-Cup Co. show their steam-engine lubricators. The Portland Stone-ware Co., terra-cotta ware drain-pipe, etc. The Ormsby Sash Balance Co., sash-balances. The New England Terra-Cotta Lumber Co. show their terra-cotta lumber for fire-proofing buildings. Samuel Cabot, Boston, creosote wood-preserving stains, has a 6x8 model of a \$15,000 house, Queen Anne style, shingled all over, giving an excellent idea of the effect of his stains. The New England Heat-Regulator Co. show the Butz electric heat-regulator. Tingley & Dorrance, Providence, R. I., tile and brass registers, brass-work, etc. Reading, Baird & Co., Boston, show stained glass. Errico & Co., terra-cotta and majolica works of art, bronzes, etc. The Lowe Tile and Metal Manufacturing Co., of Chelsea, have a large display of tiles in every shape. They also have a large exhibit of their specialties in artistic combinations in tiles and metals. Amongst them are tile-lamps, tea-bells, table-

stands, inkstands, candle-sticks, twine-reels, letter-files, ash-trays, etc.

Charles W. Trainer & Co., Boston, show the various products of the H. W. Johns Manufacturing Co., consisting of stove lining, furnace cement, corded sheathing, asbestos steam packing, pipe and boiler coverings, etc. The Chalmers-Spence Co., of New York, show samples of their asbestos pipe covering. The Crosby Automatic Signal Co., of Providence, R. I., have on view their automatic fog signals. The Dana Wind-Engine Co., of Fair Haven, Mass., has one of their 16-foot centrifugal governor wind-engines placed on the roof of the exhibition building, connected by a line of shafting with shaftings and pulleys, for running a circular saw and grinding mill. The Simonds Manufacturing Co., of New York, have the wing disc fan or exhauster and the wing-fan-ventilator.

The Soule Photograph Co. and L. Prang & Co. have on view a fine exhibit of their respective productions.

The stove, range, and furnace houses are well represented. We notice a good display from the Smith and Anthony Stove Co., David W. Cushing, the Magee Furnace Co., the Weir Stove Co., the Ridgeway Furnace and Stove Co., the Taunton Iron-Works, the Barstow Stove Co., and S. M. Howes & Co.

The American Conduit and Construction Co. exhibit carbonized stone conduits for electric wires.

The Perth Amboy Terra-Cotta Co. have a fine exhibit of architectural terra-cotta, including some specimens of interior work and Pompeian terra-cotta. The Boston Architectural Terra-Cotta Works, H. A. Lewis, proprietor, has recently amalgamated with the Perth Amboy Co., and this exhibit is the combined effort of the two concerns. The commission for the city of Boston for testing the merits of the several water-meters are continuing their labors at the Exhibition Building; having occupied the space for some time, and not having completed their work, their apparatus has been entered as an exhibit.

ARCHITECTURAL COMPETITIONS.

MINNEAPOLIS.—The Court House and City Hall Commission have appropriated \$4,000 for competitive plans for new court house and city hall. Most meritorious plan, \$1,500; second, \$1,000; third, \$600; fourth, \$500; fifth, \$400. These plans to remain the property of the Board. If any one of the competitors is selected the money given for his plans shall be counted in his competition. The official announcement may be found in our advertising columns and the instructions may be secured at the office of THE ENGINEERING AND BUILDING RECORD.

MISCELLANEOUS.

MILWAUKEE.—The work of the City Engineer on the proposed flushing-tunnel has been stopped, as the Chicago and North-western Railway refuse to grant the right of way under their tracks unless the city authorities permit the railroad company to build a solid sea wall from a point on the Lake opposite the foot of Mason Street to the lighthouse pier, to be not less than 200 feet from the shore. The new breakwater will be twenty feet wide and fifteen feet above the water-level, and will have a railing on either side so that it can be used as a promenade. A foot-bridge will be built connecting the end of the breakwater to Juneau Park.

MILWAUKEE.—The statue of Leif Erickson is on its way here, and the contract for erecting the pedestal has been let to Cook & Hyde. The pedestal weighs 41,740 pounds, and the statue weighs 1,200 pounds. The entire height of the statue and pedestal will be 18 feet. M. H. Mosman is the founder of the statue.

POMONA, CAL.—The San Antonio and Holt Avenue Railroad Company has filed articles of incorporation to construct a street railroad in Pomona, from the intersection of Second and Elizabeth Streets to the San Bernardino Road. Capital stock, \$25,000.

ELIZABETH, PA.—Editor Wiley and Dr. Sheaffer represent the stockholders of the company organized to build a bridge across the Monongahela River at Elizabeth.

DENVER, COL.—The *Tribune* is strongly urging the matter of paving the streets of the city.

MILWAUKEE, WIS.—The Milwaukee and Northern Railroad will be extended to Rockland, a distance of sixty miles. The line has already been surveyed.

SAN DIEGO, CAL.—The application of Milton Sauter to build a wharf on D Street has been granted. The wharf is to be 3,700 feet long; estimated cost, \$50,000.

SAN DIEGO, CAL.—It is reported that owing to the immense amount of building of all kinds that is going on in this city and vicinity, the municipal authorities are experiencing difficulty in securing contractors to perform street work. It is stated that there are some 14 streets in the city which have been ordered graded and advertisements for proposals have been issued without any resulting bids.

NEW INCORPORATIONS.

MILWAUKEE.—Incorporated is the Home Building and Loan Association of Milwaukee. C. A. Chapin, E. G. Timme, and others are incorporators. The capital stock is \$500,000.

PORTLAND, ME.—Organized is the New England Liquid Fuel Company at Portland, with a capital stock of \$15,000. The stockholders are Oliver P. Prall, West Somerville, Mass.; John Gray and others, Arlington, Mass.

BROWNSFIELD, PA.—The Redstone Water Company has been incorporated; capital stock, \$6,000. W. C. Magee, J. M. Schoonmaker, Pressley H. Moore, and L. H. Schoonmaker, incorporators.

THE Pacific Sewerage Company; incorporators, A. M. Jordan, Atlantic City; W. S. Snyder, and A. C. Cramer, of Philadelphia. The Red Lion Town Site Company; capital stock, \$25,000; incorporators, F. O. Bell, S. M. Martin, John Zigler, and E. O. Wight. The Teocalli Mining Company; capital stock, \$100,000; incorporators, Edward Royston, of Pueblo, and the following citizens of Marysville, Mo.: F. M. Cooper, S. W. Briggs, Frank Baummann, J. K. Whidbee, O. P. Torrance, and E. A. Vinsonhaler.

NEWARK, N. J.—The United States Traction Company has filed articles of incorporation. The capital stock is \$1,000,000 and the incorporators are Andros B. Stone and Eugene M. Cole, of New York, and T. Walter Griffith, of Newark. The object is to build street cable railroads and construct elevated and underground railroads.

North-Western Gas-Saving Co., of Chicago; capital stock, \$50,000; incorporators, Charles C. Rice, S. August Gould, L. R. Vastine. The Niagara Falls Hydraulic Power and Motor Company, at Chicago; capital stock, \$15,000,000; incorporators, M. Morgner, E. C. Phillips, and E. B. Morgner. The Phillips Economical Cable-Grip Construction Company, capital stock, \$5,000,000; incorporators, R. Morgner, E. C. Phillips, and E. B. Morgner. Commonwealth Gas Co., at Chicago; capital stock, \$500,000; the incorporators are J. G. Aldrich, B. F. Cummings, and Edward H. Turner.

The Chicago Western Elevated Railway Company; capital stock, \$20,000,000; for the construction and operation of an elevated railroad from a point on Michigan Avenue, between South Water Street and Monroe, running west to the west line of Cook County; incorporators, James Felch, George S. Calkins, and Ezra L. Brainerd. The Chicago Rapid Transit Company; capital stock, \$1,500,000; to construct and operate elevated railways within and without the city of Chicago and its suburbs; incorporators, George C. Buell, Edward S. Richards, and James C. Beeks. The Edison Illuminating Company, of Monmouth; capital stock, \$10,000; incorporators, H. H. Pattee, H. A. Scott, and W. B. Smith.

THE New York Electric Construction Company; capital, \$50,000.

THE Young-Brennan Crusher Company, of New York; capital, \$200,000.

TUCSON, ARIZ.—Articles of incorporation have been filed by the Canoya Canal Company, with a capital of \$500,000. The object is to take out a grand irrigating canal to reclaim land in Santa Cruz valley, between Tucson and Calabasas. One hundred thousand acres will be reclaimed.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.



For works for which proposals are requested see also the "Proposal Column," pages 697-700-703-704.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE. ETC.

ROCHESTER, PA.—John M. Buchanan, of Beaver; Dr. H. S. McConnell, of New Brighton; A. W. McCoy, of this place; Ellis Morrison, and E. A. Phillips, of New Castle, compose the Rochester Water Pumping Company, which proposes to erect works here within the coming year if the prospects will warrant it. Already the Town Council has contracted for sixty plugs at a cost of \$2,750 per year, and a tour of the various factories, etc., is being made for the purpose of ascertaining whether \$6,500 worth of contracts per year can be made. The entire plant as at present planned will cost over \$130,000. Locations for the pump-station, as well as the reservoir, have already been chosen, and will be purchased within the next week or two.

ALBERT LEA, MINN.—This place is to have a system of water-works. Three or four miles of mains will be laid, and about \$30,000 will be expended. For particulars address C. H. Farnsworth, at this place.

SULLIVAN, ILL.—At a recent meeting of the City Council it was decided to expend \$25,000 for new water-works. The wells of the old works will be used.

BRISTOL, TENN.—The water-works question is being agitated here.

BATH, L. I.—A sewerage system to cost \$100,000 is in contemplation here.

BATON ROUGE, LA.—The City Council has contracted with Mr. Wood, of Dubuque, Iowa, for the building of a system of water-works in this city, agreeing to pay \$4,500 per year for seventy-five hydrants. Work is to begin soon and be completed within six months.

WINDOM, KAN.—Our correspondent writes: "The Mayor and City Council have passed an ordinance submitting to the vote of the citizens of the city of Windom a proposition to vote bonds to the amount of \$8,000 for the purpose of building and operating a system of water-works, the said election to take place November 15."

CHARLESTON, S. C.—Our correspondent writes: "The city of Charleston, S. C., has ten artesian wells, about 2,000 feet deep, yielding about 700,000 gallons daily. These wells flow into a reservoir of 3,000,000 gallons capacity, situated in the heart of the city, from whence the water is pumped into a stand pipe ninety feet high and eighteen feet in diameter. A third well is now being bored upwards of a mile from the present reservoir and pumping station, and it is proposed to construct at that point a reservoir of 5,000,000 gallons capacity, into which the water from the new well will flow, and from which it will be conveyed by gravity through cast-iron pipes of ten inches diameter, to the central reservoir whenever needed. This third well is expected to be of larger size than the others, and it is hoped will yield over a million gallons daily."

CAZENOVIA, N. Y.—Our correspondent writes: "There has been no steps taken looking to the establishing of water-works, further than that parties have been here looking the thing over, but there has been no movement in that direction by the people."

LAKE FOREST, ILL.—Our correspondent writes: "No steps have been taken yet and nothing will be done before spring."

SEBASTOPOL, CAL.—Our correspondent writes: "This is not an incorporated city and there are no water-works, only for my private use, of engine for pumping tanks of 21,000 gallons."

ST. PAUL, MINN.—The water board has let the contract for the high-service distributing-reservoir, which is to be begun April 15, next year, and completed October 12: McArthur Bros. bid \$97,681.45; J. D. Moran, \$114,006.50; the Fruin-Bambroch Construction Company, of St. Louis, \$115,526.05, and J. J. Palmer, of Minneapolis, \$119,102.39. The contract was awarded to McArthur Bros. The work will be done under the supervision of H. H. Harrison, of Stillwater, engineer of the board, and Professor J. T. Fanning, of Minneapolis, Consulting Engineer. In the bid of McArthur Bros. forty tons of pipes and special castings will be used, and twelve tons of gate-valves and curbs.

WESTERVILLE, O.—The question of building water-works is being agitated here.

MISSOURI VALLEY, IA.—Our correspondent writes: "The City Council ordered an unofficial vote at the State election on the question of bonding the city in the sum of \$25,000 to erect water-works, merely to get the expression of the people. The question carried by a large majority in favor of bonds and the Council will probably vote bonds some time before spring and begin the erection of water-works as soon as the season opens up."

SPARTANBURG, S. C.—Our correspondent writes: "Contract for water-works has been let to Moffit, Hodgkins & Clark, of Watertown, N. Y., who will go to work very soon."

ST. LOUIS, MO.—An extension to the water-works, to cost \$700,000, is to be made. For particulars address Comptroller Campbell, this city.

LAKE LINDEN, MICH.—This place will be bonded for \$10,000 to put in a water-works plant.

JERSEY CITY, N. J.—The Board of Public Works has awarded the contract for covering the water-main, which is composed of cement, to Thomas Cavanaugh, the lowest bidder.

COLUMBIA, S. C.—Our correspondent writes: "We have had plans drawn for new reservoir and have solicited bids from all of the best pump-makers that we know of in the country, and as soon as replies are received will order the pumps at once. The committee have not yet decided whether they will purchase a one or one and a half million gallons capacity pump in twelve hours. The work on reservoir and purchasing pump will be pushed with all possible speed consistent with good work, and purchase of a No. 1 pump."

COLUMBUS, O.—Our correspondent writes: "The laying of additional pipe-lines has been postponed for the present."

EAST ORANGE, N. J.—Our correspondent writes: "No steps have been taken to extend the sewerage system beyond the original plans in the township of East Orange, which is now in progress of construction."

WALTHAM, MASS.—Our correspondent writes: "The sum of \$600 has been appropriated for preparing plans for a sewerage system, and the Mayor has been requested to petition the next Legislature for a special act authorizing the city to borrow money to construct drains and sewers."

HAVERHILL, MASS.—Address Joseph H. Sheldon, Mayor, for proposals for furnishing materials and constructing marginal sewers, until November 25.

VICKSBURG, MISS.—Our correspondent writes: "This city has contracted with the firm of Samuel R. Bullock & Co., of New York, for a system of water-works, which are now in the course of construction and will be completed in the course of three or four months."

ROME, GA.—It is proposed to form a \$100,000 stock company to buy the Rome Water-Works. J. W. Rounsaville can give information.

PINE BLUFF, ARK.—The Pine Bluff Water-Power Company has been incorporated; capital stock, \$150,000.

NEWPORT, R. I.—Our correspondent writes: "The only work contemplated at present is building a storm overflow by hired labor."

TECUMSEH, MICH., is to have a water-works system. Address F. B. Wood.

ALFRED CENTRE, N. Y.—A system of water-works will be constructed here.

BELLEVILLE, ILL.—Our correspondent says, in reference to an item published recently, saying that water-works were to be established here: "We have water-works established 3 years ago."

MT. VERNON, N. Y.—Our correspondent writes: "The Mt. Vernon village officials are constructing a new sewer. Mr. Otto Hirfeland, Mt. Vernon, N. Y., is Clerk to the Commissioners having the matter in hand."

COLUMBUS, GA.—Our correspondent writes: "This city has been building sewers of various lengths in those portions of the city as were most needing them, generally by contract, and has expended for same about \$17,000 this year. I presume the same plan will be pursued next year. A definite and enlarged plan, I think, would be desirable."

PITTSBURG, PA.—It was evidently an error in reporting water-works at North Versailles last week. Our correspondent writes: "Referring to your inquiry above, state that I am not aware of any such improvement being made or contemplated at North Versailles, this county, as it is a small country village and cannot support a water-works of any kind."

MILWAUKEE.—A large sewer will be built along Chestnut Street, extending through the Highland Home property, recently purchased by Harrison & Green.

WAUPUN, WIS.—Boring in the public artesian well has ceased at a depth of nearly 800 feet. The Common Council directed the contractor to pipe and pack the well, with the hope of getting a flow of water. If, after this job is done, the well will not flow at the surface, it will be supplied with a pump.

BRIDGEPORT, CONN.—Negotiations are in progress between prominent stockholders of both the water companies of this city which will undoubtedly result in a short time in the combination of the interests of the two for business purposes under one control, and the advantages of the new water-supply from Mill River will be secured to Bridgeport and West Stratford without putting down another set of pipes save wherever streets are not already piped or need a larger or better supply.

WINSTON, N. C., November 14.—Our correspondent writes: "The question of sewerage is lying dormant now, but I think it will be put through during 1888."

SALISBURY, MD.—Our correspondent writes that there are no new developments concerning the water-works project.

WHITESTONE, N. Y.—Our correspondent writes in relation to the water-works project at this place: "The Trustees have in view a negotiation with the village of College Point for a water-supply. No decided steps have been taken other than requesting their President to ascertain what can be done in the matter."

CLEBURNE, TEXAS.—Our correspondent writes concerning the project to increase the water-supply: "The city has contracted for an artesian well, which is now bored about 800 feet. Water is within 120 feet of surface, and they expect to continue boring until a flowing well is secured. There is a determination on the part of the city to secure an abundant supply at any cost."

BROOKLYN, N. Y.—Austin Corbin, President of the Long Island Railroad, has given the city the privilege of constructing the conduit through lands owned by his company in Merrick, Redwood, and South Oyster Bay, through which places the conduit will be built instead of over the route originally intended, thereby removing the obstacle in the way of the proposed extension of the Brooklyn Water-Works. It is now thought that the dead-lock in regard to the extension of the water-works will soon be broken.

GEORGETOWN, KY.—Proposals wanted for a system of water-works. Until November 21. Address Moore & Thompson, this city.

SAN BERNARDINO, CAL.—The West Highlands Water Co. has been incorporated; capital stock, \$90,000. Seth Marshall, A. E. Sterling and others, incorporators.

SAN FRANCISCO, CAL.—The Laguna Blanca Water Co. has been incorporated; capital stock, \$1,000,000. Timothy Hopkins and S. T. Gage, of Oakland, and others, incorporators.

HERMOSA, CAL.—The Hermosa Water Co. has been incorporated; capital stock, \$192,000. Reidorf Almind, H. W. Lawrence and others, incorporators.

PLYMOUTH, IND.—Our correspondent says: "Have not decided as to the system but think we shall have the 'direct system.' We cannot bond the city to exceed \$160,000. At present I can give no further information."

WOODSTOCK, VT.—The water-works are about completed. A 15,000,000 gallon reservoir has been constructed and 7 miles of pipe have been put in. The work is being done by T. William Harris & Co., of New York.

GRAFTON, W. VA.—Water-works will be erected here. Henry S. Wilson can give information.

MYSTIC, CONN.—Our correspondent writes: "Last winter there was a charter granted by the Legislature for water works for Mystic and Stonington, and I don't know what they will do; it will depend on the Railroad Company at Stonington."

BATH, N. Y.—Our correspondent writes: "There has been nothing done in the sewerage matter as yet. We have only called the people together to get their views as to the manner, and get some idea as to the cost."

GENESEO, ILL.—Our correspondent writes: "Our water-works, composed of steam-engines, apparatus, water-mains, etc., up to last spring have cost the city about \$25,000, to which we have added this season an artesian well 2,250 feet deep, giving us a flow of 200 gallons of beautiful mineral water per minute at a cost of \$6,000. We are now extending our water-mains 13,500 feet, which will be completed in ten days, at a cost of \$11,000 or \$12,000."

KEOKUK, IA.—Our correspondent writes: "The question of establishing a general sewerage system has been under discussion several times by our City Council, but has not assumed any shape. Our city needs a perfect system, and must, of necessity, adapt something very soon. About 2,000 or 3,000 feet of main sewer will be constructed this winter or next year, without doubt."

STAUNTON, ILL.—Our correspondent writes: "An election has been called for December 15 to see whether the people will authorize the Trustees to issue bonds for the purpose of building water-works."

PRINCETON, ILL.—Our correspondent writes: "Water-works are under contemplation on a small scale; \$5,000 has been voted and appropriated for an artesian well, and the Mayor has advertised for bids for sinking the same."

JAMESTOWN, N. Y.—Our correspondent writes: "The water company, of this city, has driven four 8-inch artesian wells at Levant, about four miles from this city, which are now flowing. The company proposes to bring the water from those wells for city use."

HENDERSONVILLE, N. C.—Our correspondent says: "No sewerage system has been inaugurated, but one may succeed the completion of the water-works system."

TUSCUMBIA, A. I. A.—Our correspondent writes in regard to the water-works of East Sheffield and Tuscumbia: "All the stock has been taken in the above-styled company but no further progress as yet."

READING, PA.—Our correspondent writes: "The Water Board will recommend to Councils that action be taken looking to an increase of the supply during next year."

MERRIAM, MINN.—Water-works are wanted here.

HUMMELSTOWN, PA.—Contracts for the water-works have been given out footing up \$40,000. Schaeffer, Mukel & Co., of Fleetwood, will put in the machinery at a cost of \$9,000. Raymond & Campbell, of Middletown, will furnish and put in the conduit and standpipes for \$27,000. Other contracts, cost of ground, etc., run the total up to more than \$45,000.

BOUND BROOK, N. J.—Address the Commissioners in regard to water-works system to be constructed here.

LOUISVILLE, KY.—The Louisville Water-Works Co. propose extending their water-works system.

PIPSTONE, MINN.—Our correspondent writes: "This place voted \$20,000 for water-works November 14."

WINCHESTER, KY.—Our correspondent writes: "The Council has appointed a committee, Messrs. William A. Attersall and Joseph H. Frazer, who have visited Lexington, Frankfort and Louisville to investigate water-works systems in view of establishing a plant here, but circumstances have been such that they have not been able to report. Nothing will be done until they report."

HOBOKEN, N. J.—Our correspondent writes: "The Jamestown system of water-works is recommended for this city."

MILWAUKEE, WIS.—An engineer for the county water-works is wanted. The position is a new one and will be made effective. The salary will be \$1,500 per annum.

BRIDGES.

GREEN BAY, WIS.—Our correspondent writes: "No steps taken yet toward the construction of a draw on Walnut Street bridge. Before any is taken by the authorities the matter will have to be voted on by the voters of the city, and in case the vote is in favor of the improvement the city will have to issue bonds to pay for it."

COLUMBUS, NEB.—Plans for the bridge across the Loup Fork River have been examined by the township and city authorities of Columbus, and accepted the plan of the Campbell Bridge Company, of Council Bluffs, Iowa, at an estimated cost of \$37,000.

ROME, GEO.—The contract for the bridge over the Postanula has been awarded to the Penn Bridge Co. for \$13,457, the company to take down the old bridge and place it on the river bank. The bridge will be 297 feet long, with the draw 197 feet long; the other 100 feet, will have a roadway twenty feet wide. The piers will be all stone.

NEW GLASGOW, N. S.—The people are agitating the question of erecting a bridge over the East River to connect with Stellarton.

TROY, N. Y.—The directors of the Troy Union Railroad Co. have awarded the contract for constructing a new bridge at Pine Street to Van Zile & Co., of Albany, N. Y.

BEVERLY, MASS.—Our correspondent writes that the County Commissioners have taken no action toward the erection of a bridge over the railroad from Rantoul to River Streets.

SEYMOUR, IND.—The County Commissioners will build a bridge here.

KANSAS CITY, MO.—It is reported that the County Court has ordered four new bridges to be constructed across Brush Creek, O. K. Creek, and the Little Blue River; all to be of iron, the longest one to be 300x60 feet in size, and two of them will be built so as to allow cable cars to pass over them.

NORTH PLATTE, NEB.—It is reported that North Platte and Lincoln County will vote on bonding the county for \$60,000 to build five bridges across the Platte River.

LA CAMAS, WASH. T.—A bridge is to be built across the Columbia River from the Oregon side to La Camas, Washington Territory.

MENOMINEE, MICH.—Address the County Commissioners in regard to a bridge, to cost \$70,000, to be constructed here.

CHICAGO, ILL.—A. Gottlieb & Co. have been awarded the contract for building the Jackson Street viaduct at \$89,840.

GAS AND ELECTRIC LIGHTING.

INDIANAPOLIS, IND.—This city is about to buy \$100,000 worth of wrought-iron pipe to conduct natural gas here from wells twenty miles away.

FORT EDWARD, N. Y.—This place is to be lighted with electricity by a company of local capitalists.

UTICA, N. Y.—The New York Electric Construction Co., of New York City, has been awarded the contract to establish a plant here.

ALBANY, N. Y.—The city has contracted with the Westinghouse Electrical Co. to construct a plant for 2,600 lights.

COLUMBUS, O.—A contract has been made with the Westinghouse Electrical Co. to erect a plant for 2,600 lights.

RED BANK, N. J.—This place will be lighted by electricity. A \$10,000 plant will be established and a franchise will be granted as soon as the company is fully organized.

TAUNTON, MASS.—The Frank S. Marr Construction Company is preparing to put 1,250 incandescent lamps into the Hoosac Tunnel. The Westinghouse alternating system will be used.

KNOXVILLE, TENN.—The report of the Board of Public Works favoring electric light to gas has been received and accepted by the Board of Aldermen.

CARLISLE, PA.—An electric light and steam heating company has been organized and is asking permission of councils to erect the necessary poles and plant.

VICTORIA, TEX.—There are prospects of an electric-light plant being erected.

ITHACA, MICH.—An Edison electric-light company has been organized here.

HUTCHINSON, KAN.—An electric-light plant will be erected here at once.

BRISTOL, TENN.—The Thomson-Houston Electric Light Company have a franchise to erect a plant here. Work will be begun at once.

KEOKUK, IOWA.—The people are agitating a cheaper system of electric lights.

TALLAHASSEE, FLA.—The City Council has contracted with the Tallahassee Brush Electric Light Company to light the streets of Tallahassee for the term of five years. The hotels and stores will also use the light, and it will be used in the Capitol during the session of the Legislature.

NEW CORPORATIONS.—The Lock Haven Electric Light Co., of Lock Haven, Pa., has been incorporated. Capital stock, \$20,000. Samuel Christ, T. C. Kintzing, and others, incorporators.—The Lamar Electric Light and Gas Co., of Lamar, Col., has been incorporated. Capital stock, \$50,000. T. J. Mathews, O. G. Hess, and others, incorporators.—The Staten Island Electric Co., of New Brighton, S. I., has been incorporated. Capital stock, \$10,000. Fred B. Hawley, Edwin T. Copeland, and others, incorporators.—The New York Electric Construction Co., City, has been incorporated. Capital stock, \$50,000. Andrew L. Souard, J. H. Hapgood, and others, incorporators.—The Martinez Gas and Electric Light Co., of Martinez, Cal., has been incorporated. Capital stock, \$50,000. J. Strenzel, D. Thomas, and others, incorporators.—The Thomaston Electric Light Co., of Thomaston, Conn., has been incorporated. Capital stock, \$20,000. Aaron Thomas, B. W. Pease, and others, incorporators.—The Schuyler Electric Co., of Middletown, Conn., has been incorporated. Capital stock, \$250,000. Seth H. Butler, John N. Camp, and others, incorporators.—The Anniston Gas-Light Co., of Anniston, Ala., has been incorporated, with W. G. Ledbetter as President.—The Lamar, Col., Electric and Gas Light Co., with \$50,000 capital, has been incorporated. O. G. Hess, W. W. London, and others are the incorporators.

GREENVILLE, S. C.—Julius H. Howard has made a proposition to light the city with electric lights.

CHADRON, NEB.—It is probable that a system of electric lights will be wanted here shortly.

TROY, N. Y.—The contract with the Edison Electric-Light Company for lighting the depot of the Troy Union Railroad Co. has been ratified. The company agrees to have the electric-light in operation December 15.

FORT EDWARD, N. Y.—Our correspondent writes: "Electric-Light Company just formed; Westinghouse system in operation in Fourth to Sixth Streets."

NEWPORT, O.—The Kentucky Electric-Light Co. has been refused a franchise to erect a plant here.

HYDE PARK, ILL.—An ordinance has been passed giving the Economic Electric-Light and Gas Co. permission to locate and operate a system of gas and electric-light at the rate of \$1.25 per thousand feet gas, electric arc-lights at sixty cents per night, and ten cents per night for incandescent light.

RAILROADS, CANALS, ETC.

WHEELING, W. VA.—The contract to build the Wheeling Electrical Railroad has been awarded to John Robrecht.

MADISON, WIS.—The Madison City Railway Company has filed articles of incorporation. The capital stock is \$30,000. The incorporators are E. W. Keyes, Joseph S. Keyes, and George Wolf.

BETHELEHEM, PA.—The Plymouth Passenger Railway Co. has been incorporated with a capital of \$12,000.

INDIANAPOLIS, IND.—The Central Indiana Railroad Company has been incorporated. It proposes to build a line from Fort Wayne to Terre Haute, a distance of 200 miles. The capital stock is given at \$100,000, of which Lewis J. Highland has subscribed 986 shares.

ROME, GA.—Address J. W. English, President Chattanooga Brick Co., for particulars concerning proposals wanted for grading, masonry, trestling, and all other parts of railroad construction on the Chattanooga, Rome and Columbus Railroad.

MADISON, WIS.—The Portage and South-Western Railroad has been incorporated. It proposes to build a road from Portage City to a point on the boundary between Wisconsin and Illinois, together with a branch from some point on the line in Dane County to Madison. The total distance is 135 miles. The capital stock is \$3,750,000. The incorporators and first board of directors are Bluford Wilson, Frank H. Jones, Samuel T. Dresser, Timothy McGrath, and Henry A. Stevens, all of Springfield, Ill.

STUEBENVILLE, O.—An electric railway is to be built here. T. William Harris, of 2 Nassau Street, New York, is the consulting engineer, and Wilbur F. Goodrich, M. A. S. C. E., is to make the surveys.

WILMINGTON, DEL.—This city has closed a contract with T. William Harris & Co., of New York, for putting poles, wires, etc., for an electric railway.

BIDS OPENED.

ST. PAUL, MINN.—Bids have been opened by the Board of Public Works, as follows: Feronia Avenue, from Prior Avenue to Fairview Avenue: Michael Lux and Robert Spangenberg, \$1,166; Michael F. Duggan, \$1,390; Carl Bahr and F. Kuhr, \$1,095; William A. Davern, \$1,235. Awarded to Bahr and Kuhr.

Mackubin Street, from Charles Street to Minnehaha Street: Michael Lux and Robert Spangenberg, \$3,490; William A. Davern, \$2,725; William P. Murphy, \$2,998.70; J. W. Maloney, \$2,287; G. Gerlich, \$2,150. Awarded to Gerlich.

Sewer on Mackubin Street, from Rondo Street to Carroll Street, together with the necessary catch-basins and manholes: Patrick Doherty, \$593; William Stockton and John Lindquist, \$799. Awarded to Doherty.

Sewer on Iglehart Street, from Farrington Avenue to Western Avenue, and from Mackubin Street to Dale Street, and on Dale Street from Iglehart Street to Marshall Avenue, together with the necessary catch-basins and manholes: Patrick Doherty, \$10,098; William Stockton and John Lindquist, \$8,900. The last-named bids were rejected.

The contract for paving Selby Avenue was awarded to James Forestal, at \$34,700.

CINCINNATI, O.—The contract for building the armory in this city has been awarded to James Griffiths' Sons at their bid of \$95,284.

NEW YORK CITY.—The Aqueduct Commissioners, November 16, opened the following bids for the construction of gate-house chambers and blow-offs at Pocantico, in Section 4, and at South Yonkers, in Section 9, of the aqueduct work: Section 4—Brown, Howard & Co., \$24,717.50; Thomas Dobbin, \$13,912.50, and John Peirce, \$22,410.50. Section 9—O'Brien & Clark, \$20,935; John Peirce, \$22,160.50, and Thomas Dobbin, \$22,836.20. The bids were referred to the Chief Engineer to be tabulated.

ST. LOUIS, MO.—The Board of Public Improvements received bids yesterday for the improvement of parts of Grand Avenue and Broadway. The bids for the reconstruction with granite of Broadway from Franklin Avenue to Biddle Street were: Allen & Vieths, \$21,273; P. W. Schneider, \$22,314; G. Eyer-mann, \$22,482. For the section of Broadway from Biddle to O'Fallon Street, Fred Skrainka bid \$9,868; P. W. Schneider, \$10,403; Allen & Vieths, \$9,916; G. Eyer-mann, \$10,431. The bids for the reconstruction of Grand Avenue from Laclede Avenue to the centre line of Morgan Street with pine wood blocks treated with chloride of zinc were: George Schmalz, \$58,764; Allen & Vieths, \$59,068; Fred Skrainka, \$61,060; J. Michel, \$57,665. For like reconstruction of that part of Grand Avenue between Morgan Street and Easton Avenue, Fred Skrainka bid, \$49,135; J. Michel, \$44,403; Allen & Vieths, \$47,534; George Schmalz, \$48,062. The bids for the reconstruction of Broadway from Mullanphy Street to Hempstead Street were Fred Skrainka, \$30,356; Allen & Vieths, \$29,922; G. Eyer-mann, \$31,473. Fred Skrainka bid \$18,539 for the reconstruction of Broadway, from Hempstead to Chambers Street; Allen & Vieths, \$18,281; G. Eyer-mann, \$18,232. For that section of Broadway between Chambers and North Market Fred Skrainka bid \$22,124; Allen & Vieths, \$22,229, and G. Eyer-mann, \$23,264. Broadway from North Market Street to Louis Avenue, Allen & Vieths, \$22,231; G. Eyer-mann, \$23,256. The contracts will be awarded to-day.

BOSTON, MASS.—Synopsis of bids for roofing and copper for the Chestnut Hill pumping-station, received by the Boston Water Board November 14:

Copper—E. B. Badger & Sons, \$1,695; Edward Marley & Bros., \$1,393; E. Van Noorden, \$1,995; F. H. Holton & Co., \$2,700; Awarded to Marley & Bros.

Roofing—C. S. Parker & Son, \$4,675; J. Hanigan & Son, \$5,100; George Martis, \$4,274; W. J. Maynard, \$4,525; John Farquhar & Sons, \$4,000; E. Marley & Bros., \$4,300. Awarded to Farquhar & Sons.

CHATTANOOGA, TENN.—The contract to erect two iron bridges has been awarded to the Union Iron Co. at \$2,100.

LANCASTER, PA.—The Committee on Sewerage, Drainage and Water-Works Improvement met on Friday evening and opened proposals for excavating and building the wall at the run on the new water-works grounds, as follows: John Hook, \$6.50 a perch, for wall and coping stone. J. F. Stauffer, \$6.50 per perch and 25c. per cubic yard for excavating. Kitch & Smith, \$4.90 per perch including coping of Port Deposit granite six inches thick and two feet two inches wide, at 30c. per cubic yard for excavating. Licht & Kreckel, for the entire work, \$2,750. Awarded to Kitch & Smith, as the lowest bidders.

CHATTANOOGA, TENN.—The contract to build several sewers, costing \$8,000, has been awarded to Messrs. Cleary & Davidson, of Chicago.

GOVERNMENT WORK.

SYNOPSIS of bids for plumbing and gas-piping in Court-house, etc., at Shreveport, La., opened November 15:

Mannion & Co., \$2,575; Utz & Smith, \$4,420.90

ST. LOUIS, MO.—Synopsis of bids for iron columns, etc., and girders and floor beams for Custom House, opened November 14 by the Supervising Architect of the Treasury Department: Haugh, Ketcham & Co. Iron-Works Co., \$23,645; Dearborn Foundry Co., \$25,910; Christopher & Simpson, \$24,417; South Halstead Street Iron-Works, Chicago, Ill., \$25,799; The McHenry Judge Arch. Iron Co., \$23,857; Sweeney & Bro., \$20,700; Scherpe & Koken, \$26,900; Willis Bros., \$26,500; McCarthy & Bro., \$48,480.

WACO, TEX.—Synopsis of bids for approaches to public building, opened November 15 by the Supervising Architect of the Treasury Department: McCarthy & Baldwin, \$8,969; John Boode, \$2,440; Dumesniel & Bro., \$7,625.

TYLER, TEX.—Synopsis of bids for approaches to public building opened November 14 by the Supervising Architect of the Treasury Department:

Moore & Parkhurst, \$1,498; John Myers & Son, \$7,500; Dumesniel & Bro., \$6,259; McCarthy & Baldwin, \$5,865.

THE ENGINEERING & BUILDING RECORD

AND

THE SANITARY ENGINEER.

A JOURNAL FOR THE ARCHITECT, ENGINEER, MECHANIC, AND MUNICIPAL OFFICER.

Entered according to Act of Congress in the year 1887, by HENRY C. MEYER, in the Office of the Librarian of Congress at Washington, D. C.

VOLUME 16.
NUMBER 26.

PUBLISHED EVERY SATURDAY.

NEW YORK, NOVEMBER 26, 1887.

LONDON, DECEMBER 10, 1887.

SINGLE COPIES, TEN CENTS.
Subscription, \$4.00 per year in advance, post paid.
SINGLE COPIES, SIXPENCE.
Subscription, 20s. per annum in advance, post paid.

IN AMERICA
IN GREAT
BRITAIN.

THE ENGINEERING & BUILDING RECORD, conducted by HENRY C. MEYER, is published every Saturday at 82 & 84 Fulton Street, New York. (P. O. Box 3037). Its opinions upon all technical subjects are either prepared or revised by specialists.

TERMS, \$4 PER YEAR, IN ADVANCE.

Postage Paid.

OFFICE IN GREAT BRITAIN,
92 & 93 FLEET ST., LONDON.

TERMS, 20s. PER YEAR, IN ADVANCE. Postage Paid.
SINGLE COPIES, SIXPENCE.

British and Continental subscriptions should be sent to the London office. Checks, express money, and postal orders should be made payable to the order of THE ENGINEERING & BUILDING RECORD (New York), and crossed ——— & Co.

Continental subscriptions are also received by F. A. BROCKHAUS, Esq., Querstrasse 29, Leipzig, Germany, and ASHER & Co., Unter den Linden, Berlin.

Subscriptions to the Continent of Europe and Australia, \$5; China, Japan, Sandwich Islands, Mexico and Cuba, \$5; South America, \$5.

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SIX YEARS' EXPERIENCE WITH THE MEMPHIS SEWERS.

ENGINEERS and municipal authorities will be interested in the report of Mr. Rudolph Hering, made to THE ENGINEERING AND BUILDING RECORD and published on another page, of an inspection made by him of the Memphis sewerage system, on the occasion of a recent visit to that city. We requested Mr. Hering to report especially upon the question of stoppages in pipe-sewers and the experience resulting from the attempt to dispense with manholes. The older readers of this journal will recall the controversy carried on in its columns during the years 1880 and 1881 regarding the importance of providing any sewerage system with manholes. This was started by a review we published of alternate plans proposed for the city of Newport, R. I., in our issue of December 1, 1880. In that review we commended certain features of the plan recommended by Colonel Waring, but among the objections we made to it was one condemning the proposition to omit manholes. In discussing this plan and alluding to the separate system, by which we meant the system as then understood by engineers, we stated that for certain localities it had many advocates, mentioning, among others, Sir Robert Rawlinson, Chief Engineer of the Local Government Board of Great Britain. This called out a letter from Sir Robert Rawlinson, which was published in our issue of March 15, 1881, he supposing we intended to imply that he endorsed what was called the Waring system, which, of course, included the details of construction adopted by Colonel Waring at Memphis. In this letter Mr. Rawlinson stated:

"I have written quite enough on sewerage and draining to refute the statement that I approve of the mode adopted by Colonel Waring all round, and any person may learn this by looking at my published 'Suggestions for Main Sewering' (revised to 1878).

"In these suggestions it will be seen that I insist upon right lines and true gradient, with manholes or lamp-holes at each change of line or gradient, special arrangements for steep gradients, and abundant provision for sewer and drain flushing and ventilation. In so far as Colonel Waring departs from these suggestions I entirely differ from him, and if he persists in disregarding these precautionary works against failure, without being either a wizard or a prophet, I predict failure; because the sewers when closed in will be beyond inspection without breaking down to them, and this operation must be blind, haphazard work.

"I know quite well that to work under the rules may cost more money in the outset, but will tend to great saving in the long run."

This was replied to by Colonel Waring April 1, 1881, in which he defined the essentials and non-essentials of a sewer system as follows:

ESSENTIALS.—"Exclusion of all storm water, absolute tightness, absolute cleanliness, perfect precision of gradient, regular, automatic, efficient flushing, complete ventilation, and perfect construction."

NON-ESSENTIALS.—"Lateral alignment; and facility of inspection."

On April 15, 1881, appeared a communication from Edward S. Philbrick, C. E., of Boston, in which he defended the use of manholes, and stated that—

"In omitting them Colonel Waring launched out upon new and unbeaten paths, pursuing methods which had been discarded as bad ones by nearly all engineers who had had much experience in the construction and main-

tenance of city sewers during the past generation, both in this country and in England."

This discussion on the need of manholes was continued during a portion of the year 1881, Messrs. Rawlinson, Philbrick, and G. K. Radford agreeing with the position taken by this journal in opposition to that assumed and defended by Colonel Waring. In our issue of March 20, 1884, we published a statement prepared for us by Mr. Anthony Ross, Superintendent of Sewers, giving cost of the Memphis system for the years 1882 and 1883. In 1882 fifty obstructions were reported, with a cost for removal of \$657.15. In 1883 seventy-three obstructions, at a cost for removal of \$782.75. These obstructions were all in the 6-inch laterals. Mr. Meriwether, the engineer at that time, also stated, in reply to a question from Mr. William Ham Hall, Engineer of the State of California,

"The omission of manholes caused considerable embarrassment, mainly for want of proper observation and as a means of cleaning out, etc."

Mr. Meriwether also reported that up to that time forty-four manholes had been put in by the city, "none by Waring."

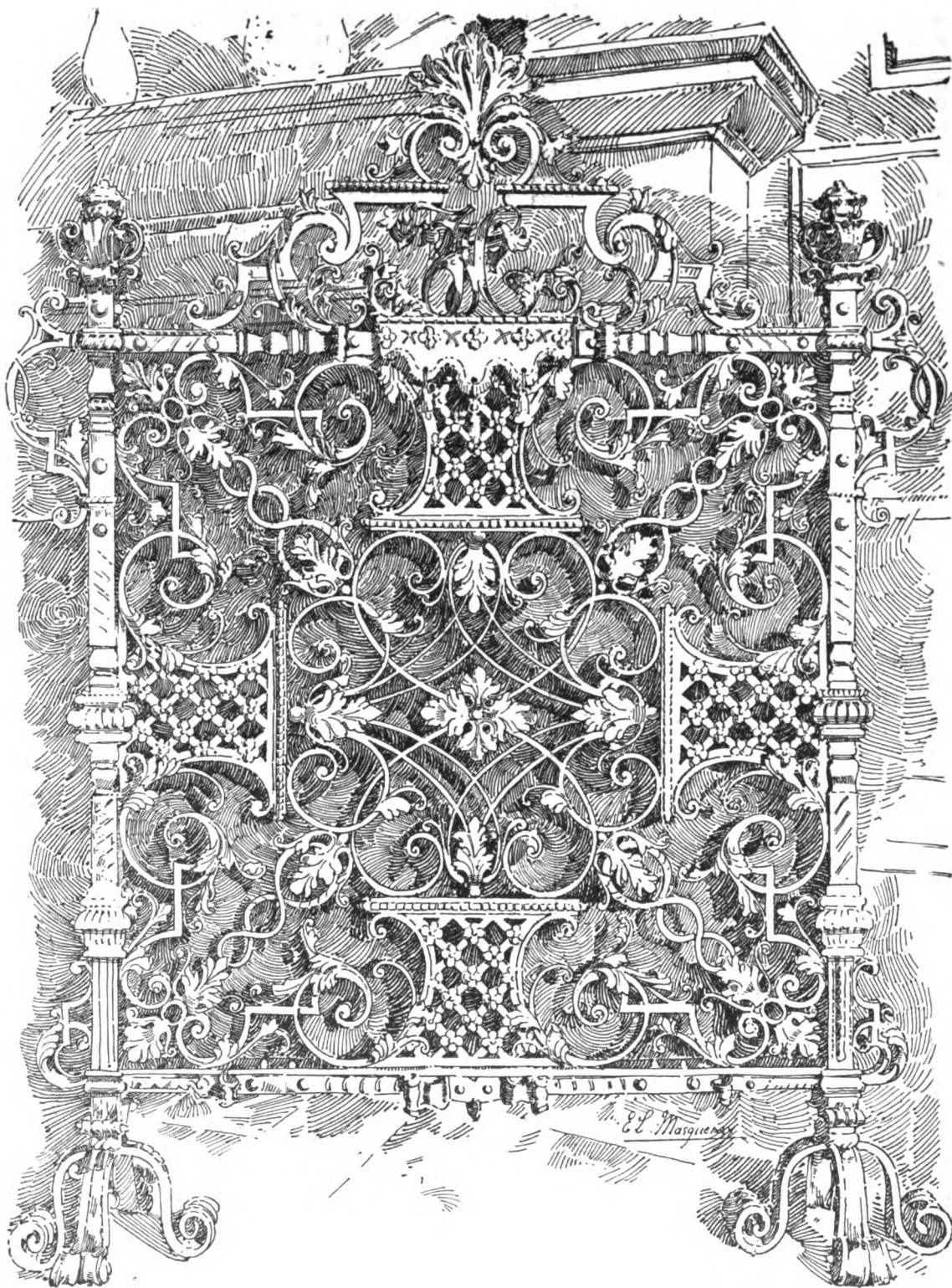
The experience as then reported in our columns at length and the present report of Mr. Hering of that acquired since that time should convince any one of the mistake of trying to reduce the first cost of a sewer system by omitting this very essential feature. We anticipate that a very considerable amount of work will be done during the next five years in the building of pipe-sewer systems, and we present this information feeling assured that it will serve a good purpose, if it enables an engineer to convince committees of laymen who have the matter under consideration that an attempt to save the cost of putting in a proper number of manholes is unwise economy.

THE FALL OF A HIGHWAY BRIDGE IN PENNSYLVANIA.

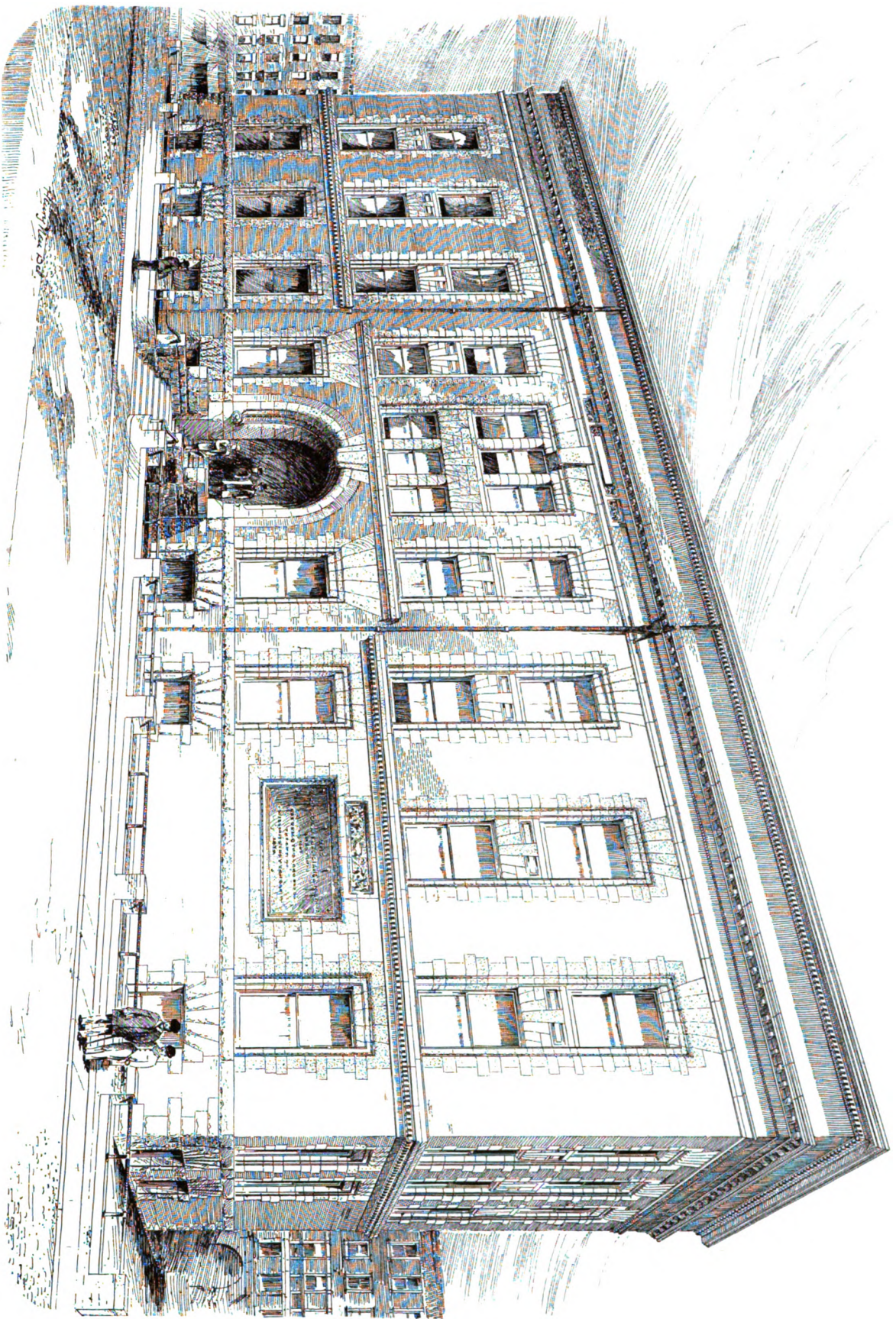
PRESS dispatches state that a highway bridge over the Juniata River at Williamsburg, Pa., fell on the 18th inst., under the load of a threshing machine and engine, killing one man and badly injuring another. The county owned the bridge, and although the authorities had been notified that the timbers were rotten and unsafe, they had neglected to repair it.

Of course the county is pecuniarily liable for damages to those obliged to use its bridges and to trust the efficiency of its authorities, and those authorities ought to be held criminally liable for the manslaughter due to their carelessness in this instance. This accident adds emphasis to the suggestion in our editorial of last week that public works on whose proper construction and maintenance the lives and property of citizens may depend should be under competent supervision controlled by the State, as town and county authorities are seldom fit to be trusted with such responsibility. Though that suggestion applied primarily to water-works the principle is of much wider application.

THE city of Munich, Bavaria, was long known as an unhealthy place to abide in, and was passed by, or hurriedly visited, by foreigners. All visitors will recall the unpleasant odors emanating from the sewers. The fact was, that the sewerage system was old-fashioned and entirely inadequate



A METAL SCREEN.—THE TIFFANY GLASS COMPANY, DESIGNERS.



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COLLEGE OF PHYSICIANS AND SURGEONS, NEW YORK.

W. WHEELER SMITH, ARCHITECT.

to the necessities of the city. This state of things lasted until 1875, when the authorities intrusted to Joseph Gordon, M. Inst. C. E., the task of laying out an entirely new system, which was finished in 1885. The *Wochenschrift des Osterr. Ingenieur und Architekten Vereines* of October 7 gives a description of this important work, which is claimed to be, in its completeness, worthy of one of the most beautiful cities of the German Empire. It is hoped that foreigners will no longer avoid the city on account of bad sewerage, for as a place of residence it is believed by many to far surpass for pleasure, education, and art the cities of Dresden, Berlin, Stuttgart, and Carlsruhe.

REMARKABLE MEETING OF HEADINGS ON THE NEW CROTON AQUEDUCT.

THIS very interesting and unusually successful bit of engineering, which has been noticed in the daily press, is described in detail on another page. So close a meeting is, we believe, unprecedented in the annals of such work, and reflects great credit on the care and skill of Mr. Wheeler and his associates.

The subsequent meeting of headings in the "Northern District" is also a very creditable piece of work, as the error was so small that two 1/4-inch drills would have struck.

RESULTS OF SIX YEARS' EXPERIENCE WITH THE MEMPHIS SEWERS.

To the Editor of THE ENGINEERING AND BUILDING RECORD:

SIR: The following is written in response to your request to report the conclusions arrived at from a recent inspection of the Memphis sewerage system while attending the meeting of the American Public Health Association, held in that city November 8-11.

It is now over six years since the sewerage of Memphis, as designed and built by Colonel George E. Waring, Jr., was completed. The deviations that were then made from the principles which had previously been elsewhere adopted—in other words, the "novelties" which entitled the system to be called "Waring system," in distinction from others—have had an ample opportunity to receive a thorough test. In view of the notoriety that had been given to it in this and foreign countries, and of the criticisms made by American and English engineers, and in your columns at the time, it was particularly interesting to see how far the praise and blame were merited, and what real advances the science of sewerage engineering had made.

The works since their completion have been in charge of Mr. Niles Meriwether, Engineer, and Mr. Anthony Ross, Superintendent. These gentlemen have endeavored to manage and extend them as far as practicable in accordance with the instructions left by Colonel Waring, and both from the interest they have taken in securing success for the work entrusted to them and from the results they achieved have proved themselves in every way competent for the task.

For the sake of clearness, let me briefly review the essential features of the "Waring" system in Memphis and point out those which were novel:

First—Exclusion of all rain-water from the sewers. While both in Europe and America the silt-bearing street-water had been excluded from sewers wherever the separate system was adopted, yet no other city had made the attempt to strictly exclude also the comparatively clean roof and yard water.

Second—Soil-drainage by an independent system of pipes leading to separate outfalls. This feature was not a novel one.

Third—Ventilation of the street-sewers through the house-drains and soil-pipes. This practice is in use in a number of European cities.

Fourth—Automatic flush-tanks at the head of all the lateral sewers. Although such tanks had before been advocated and used elsewhere, yet nowhere was it done to the same extent as in Memphis.

Fifth—No manholes on the laterals. This feature was entirely novel.

Sixth—Limitation of house-drains to a diameter of four inches. While this restriction had never before been advocated for a whole city, numerous isolated instances existed.

Seventh—Lateral sewers were to be six inches in diameter until the maximum flow of sewage filled them half full. This was likewise a new feature when applied to street sewers.

The "novelties" introduced by Colonel Waring, therefore, were:

Strict exclusion of all rain-water; use of automatic flush-tanks on every lateral; practical abolishment of manholes; house-drains limited to a diameter of four inches; and lateral sewers limited mainly to six inches.

I shall examine them in this order:

First—While in theory it may be possible to prevent persons from discharging the rain-water from their premises into the sewer, yet in practice it seems impossible. Although strict measures were applied, yet the Memphis sewers began to be so overcharged during rains by surreptitious connections that overflow-pipes had to be laid to the bayou or ditch running through the city, and last year a new 24-inch intercepting sewer, discharging directly into the Mississippi, had to be built across the city to finally relieve the nuisance caused by the storm-water overflows into the comparatively dry bayou. As there is no reason whatever in Memphis why the rain-water from houses should not go into the sewers to flush them and to relieve the property, this restriction cannot be called a good one.

Second—The use of automatic flush-tanks at the head of all the laterals does not seem to have been fully justified in Memphis. The ground is generally sloping and at many points quite steep, and the sewers would in some cases seem to be able to keep fairly clean without daily flushing. The engineer told me this was actually the fact in several instances of new laterals where no tanks had been put in. This shows that a discrimination is advisable for economical construction and maintenance. The best use for automatic flush-tanks is on flat grades, where they are sometimes almost indispensable. They must be considered rather a luxury on steep grades.

Third—The abolishment of manholes on laterals, while strenuously advocated by Colonel Waring, but disapproved of by engineers generally, must be set down as a failure. The frequent stoppages in the laterals, at the rate of about three per week,* and the consequent tearing up of the sewer, would have been avoided had there been proper means of access. Where repeated stoppages occurred manholes have been inserted, and there are now about seventy on the lateral sewers, where at first there were none. In planning for the extension of the system in the northern part of the city, Mr. Meriwether has concluded to place a manhole at every street intersection.

Fourth—The limitation of 4-inch diameter for house-pipes likewise cannot be called a success. Owing to the entrance of rubbish, which seems unpreventable in other cities as well as in Memphis, stoppages are frequent, amounting, according to Mr. Ross, to several every week. The difference between the size of the sewer-pipe and of the largest opening into it must be greater than a 4-inch pipe permits when earthen pipe is used. Experience has amply proven that a diameter of six inches is the only safe minimum for the main house-drain under such conditions. When a 4-inch pipe is relied on it needs a great fall, abundant flushing, and specially well-jointed pipes.

Fifth—The use of 6-inch pipe for street sewers has also shown itself to be an improper restriction. A report of Mr. Niles Meriwether says: "In future nothing less than 8-inch pipe will be used in the branch or lateral lines, as all the obstructions which have occurred in the branches in the past have been in the six and none in the eight inch." The same experience was already had years ago in England, where pipe-sewers were for the first time extensively used; and in America we have since had abundant confirmation. With 6-inch house pipes the 8-inch street pipes have given no trouble.

Every one of the deviations made by Colonel Waring from the principles previously adopted, and strenuously defended by him, have therefore proved to be either of minor importance or wholly objectionable.

An additional point, although not essential to the system as a general one, must not be overlooked. The sewers are often complained of as being altogether too shallow. They are generally from 4 to 6 feet deep and are unable to receive the drainage from cellars.

*Obstructions in 6-inch laterals for six weeks prior to visit:

Two during week ending October 1.
Three during week ending October 8.
Three during week ending October 15.
Three during week ending October 22.
Four during week ending October 29.
Five during week ending November 5.
Twenty obstructions in six weeks costing \$180.35 for removal.

Mr. Ross stated that they should be at least 12 feet deep to do what the people often demand. This depth is the common one in many of our cities, and for a permanent system in a large city it should generally not be less. In view of the great economy required at the time the Memphis sewers were built, it may be questioned whether the expense of twice the present depth would not have been too much of a tax on the people. An ultimate reconstruction of most of the lateral sewers, with greater depth and diameter, seems, however, inevitable.

In summing up, the conclusion seems unavoidable, regarding the essential features of the "Waring" system, as outlined above, that what was new cannot be called good, and what is good cannot be called new.

The successful working of the Memphis system, and it is generally giving satisfaction to the public, is clearly not due to any new features, but to those principles of sewer construction which have been known and practiced elsewhere for many years before, and greatly, also, to the careful and constant attention it receives at the hands of a competent force of five or six men.

Had not these works been so prominently advocated by Colonel Waring and his friends abroad as well as at home, and had not the general public been led to believe that an essential progress had been made in the art of sewer building, criticisms would likewise, I feel sure, not have been given prominence.

In one point Colonel Waring should be given great credit. At the time when it was highly important to introduce sewers in Memphis, and when the city was practically bankrupt, he suggested the separate system as the only feasible one financially against the combined, which had previously been recommended for the city. He suggested it when the system had been but little used in America and only on a much smaller scale than there required. This sagacity and courage proved of great advantage to the fever-stricken city, and the good results which rapidly followed the introduction of sewerage and other sanitary improvements should be and are fully appreciated.

RUDOLPH HERING.

OUR SPECIAL ILLUSTRATION.

COLLEGE OF PHYSICIANS AND SURGEONS.

THE subject of our special illustration is the new building of the College of Physicians and Surgeons, located in New York City, on the northerly side of Fifty-ninth Street, near Tenth Avenue, and opposite the Roosevelt Hospital. The building is isolated and therefore well supplied with light on every side. The material of the exterior consists of brick, with terra-cotta trimmings, and granite sills and lintels. The vestibule of main entrance, which is on Fifty-ninth Street, is wainscoted with marble, with steps and floor of same material.

The stairs leading to each story have a substantial framework of iron; the tread at main entrance being slate, and pine for rear stairs. The wood trimming throughout the entire building is of Georgia pine, finished in oil and varnish. All doors are ash; the walls and ceiling plain white.

The plan of building is in the form of letter T. The top of letter, representing the portion parallel with Fifty-ninth Street, is shown in the vignette; and on the first story of this portion of the building is located the office of the trustees and faculty, students' study, conversation-room, and a coat-room. On second story is the anatomical museum in the centre, with professors' rooms on the right and left. In the third story is located the department of physiology, recitation, and demonstration rooms, with the Swift Museum of Physiological Apparatus in the centre. The dissecting-rooms are located on the fourth floor, over which is constructed a skylight of unusual size.

In the central portion of the building a lecture-room is located on the first floor, with a seating capacity for 460; and directly over it is a theatre, similar in area, but with walls extending the height of two stories, which will also be used for lectures. There is only one elevator, and it will be used for transferring anatomical apparatus to the lecture-rooms.

Each floor fronting on Sixtieth Street is devoted to laboratory purposes. The plant and a section, together with illustrated description of the heating and ventilating arrangements, will be given in a subsequent issue. Mr. William H. Vanderbilt donated \$500,000 to purchase the land and erect the building, and of this sum \$300,000 was expended on this building. The architect was Mr. W. Wheeler Smith, of New York.

A METAL SCREEN—THE TIFFANY GLASS CO., DESIGNERS.

—203E SPAN, —

MILWAUKEE DRAW BRIDGE, -

—CHICAGO MILWAUKEE & ST PAUL Rwy.—

—DESIGNED AND BUILT BY—

EDGE MOOR IRON CO.,—

The Engineering Building Records

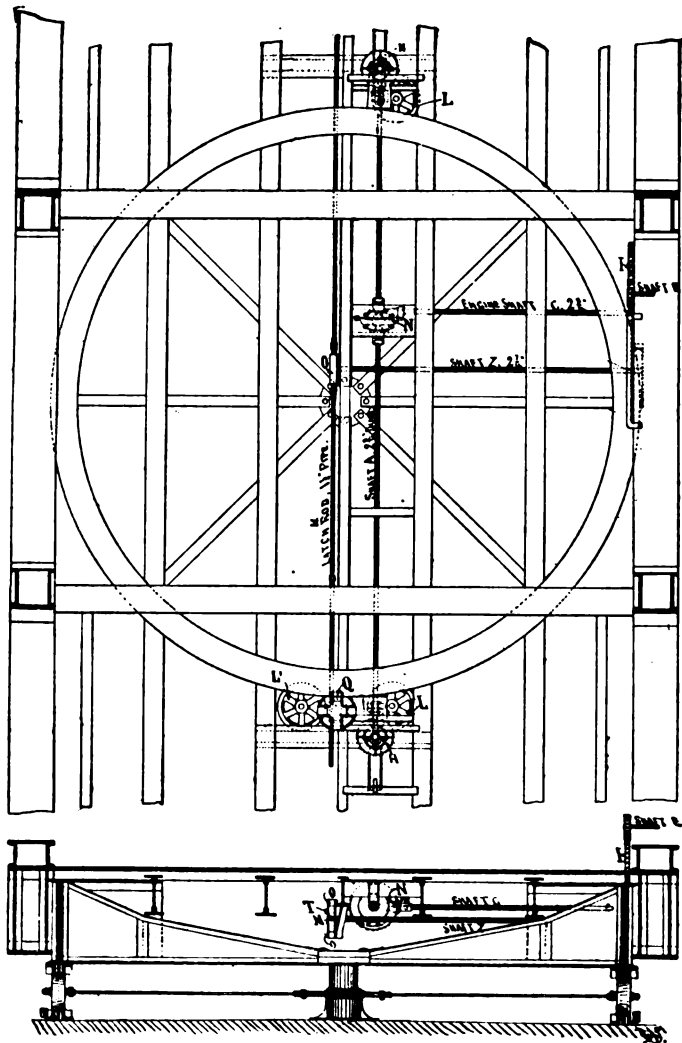
Cross Section at Centre— *Perforated Uterus—*

—Inside View—

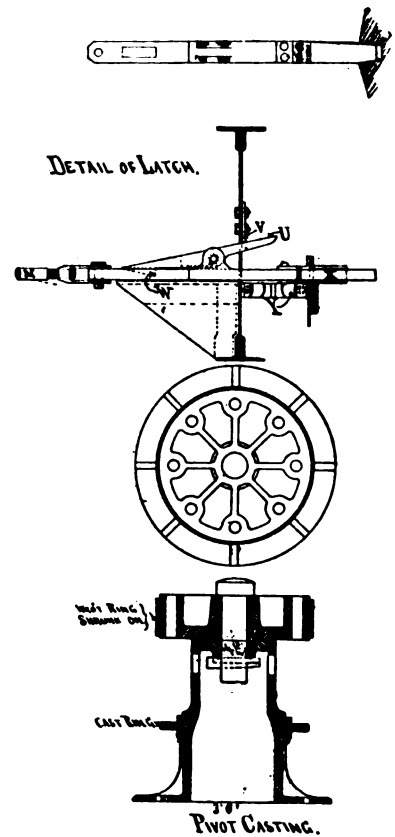
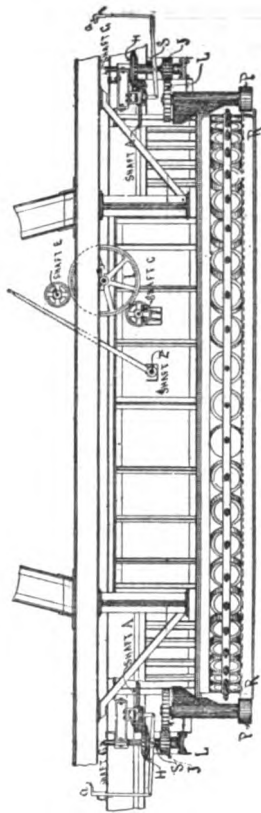
Side Elevation of Truss

—Outside there—

FOR DESCRIPTION SEE PAGE 747.



ARRANGEMENT OF DRUM MECHANISM, &c

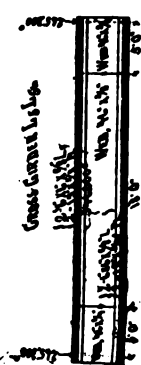
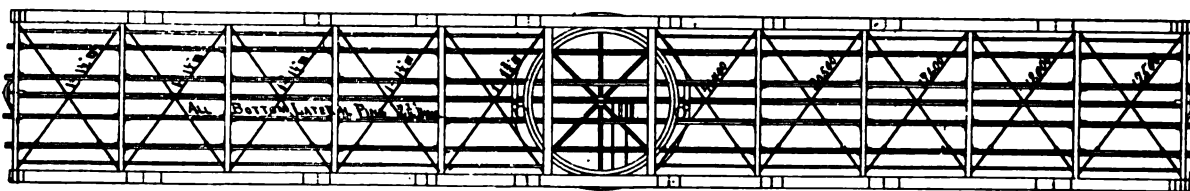
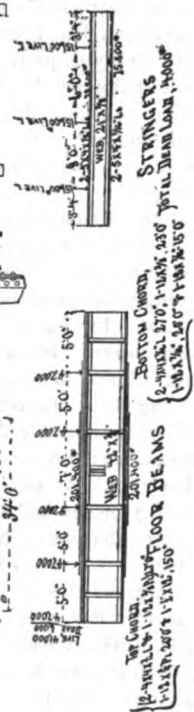
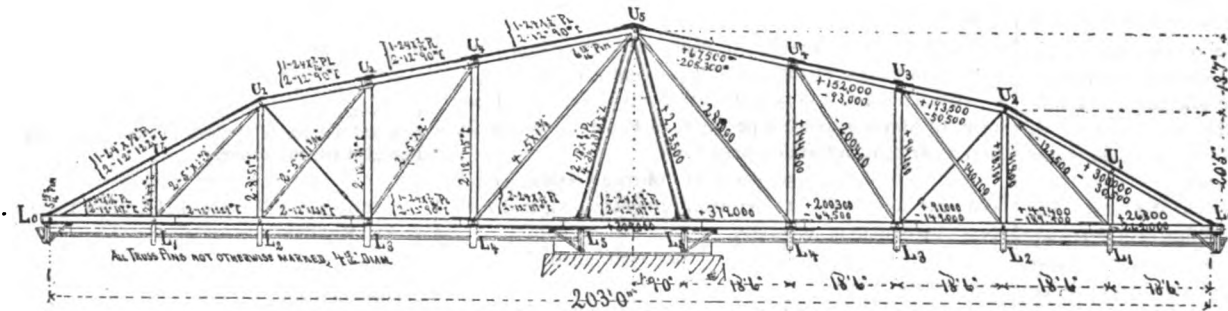
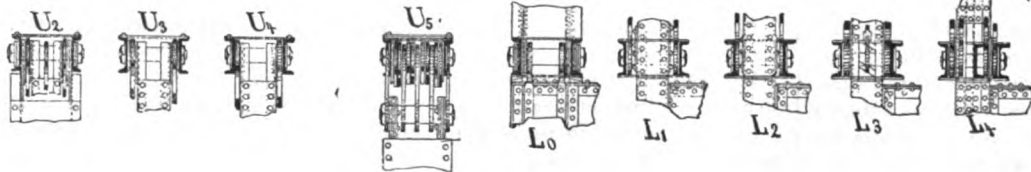
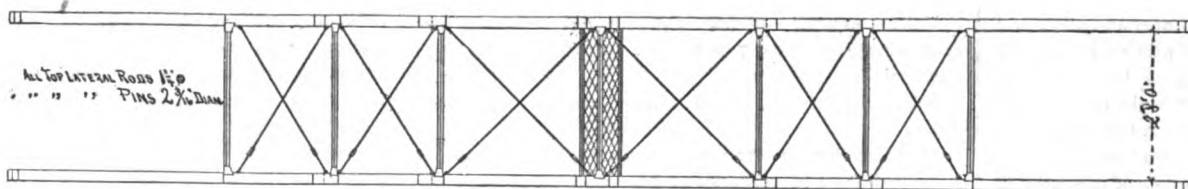


MILWAUKEE DOUBLE-TRACK DRAW SPAN.
DESIGNED & BUILT BY THE EDGEWOOD IRON CO.

for the
CHIC. MIL. & ST. P. R.R.

SHEET 3

"The Engineering Building Record"



MILWAUKEE DOUBLE-TRACK DRAW SPAN

DESIGNED & BUILT BY THE EDGEWOOD IRON CO.

for the
CHIC. MIL. & ST. P. R.R.

SHEET 2

FOR DESCRIPTION SEE PAGE 747.

REMARKABLE MEETING OF TUNNEL HEADINGS ON THE NEW CROTON AQUEDUCT.

Few people have any conception of the intense excitement felt by all miners at the meeting of tunnel headings, and the meeting, a few days ago, of the headings between the two deepest shafts on the New Croton Aqueduct—Shafts Nos. 2 and 3—was of more than usual interest to the engineers and foremen.

These shafts are located on the First Division, and are under the direction of Charles S. Gowen, Division Engineer. They are 17.5x8, and from the floor of the head-house to invert of tunnel are about 370 feet deep. They are situated 6,200 feet apart. The idea was conceived by Mr. Harry R. Wheeler, assistant engineer in charge, of trying the experiment as to whether it was possible to sink two shafts 370 feet deep and nearly a mile and a quarter apart, and establish lines in the tunnels connecting them with such accuracy as to insure that, before the last 10 or 12 feet of rock was blasted, drills could be set up in each heading on line and grade and the drill-holes made to meet.

On October 31 measurements showed that there was about 11 feet of rock between headings; accordingly, arrangements were made by Mr. Wheeler with Messrs. John McHale, Superintendent at Shaft No. 2, and John P. Small, Superintendent at Shaft No. 3, to have their assistance, and also to have their best drill-runners in the evening.

All preliminaries being arranged, Mr. W. S. Page was detailed to take charge of setting drill in the tunnel from Shaft No. 2, and Mr. Wheeler and Mr. L. C. Easton took charge of the drill in the tunnel from Shaft No. 3. The machine drills in Tunnel No. 2 were set up and started at 8:30 P. M. The rock here was a rather hard limestone, or more properly dolomite, and the drills cut very rapidly and evenly. It was nearly 10 o'clock before Messrs. Wheeler and Easton in Tunnel No. 3 had finished locating the proper position of the drill. Mr. Page at about the same time finished establishing the proper point to begin drilling the centre hole in Tunnel No. 2, and this having been done it was found that neither of the machines on the two columns in the breast could be brought to bear on the centre of the tunnel and at six feet above the invert grade, as had been previously decided. Meantime the drill that was putting in the lower cut hole on the east side in Tunnel No. 2 broke through into No. 3, thus making a hole through which the men in the two headings could converse. No advantage however, was, or could conveniently have been taken of this opening to correct the alignment. Mr. Wheeler, being told that it was not possible, without moving one of the columns in Tunnel No. 2, to set up that drill on the centre line, decided to have the two drills set six inches west of centre line, and this was accordingly done, and the drill in No. 2 started at about 10:30 P. M. In Tunnel No. 3 considerable difficulty was encountered in setting up the drill, and it was about fifteen minutes later when it was started. After drilling about 1½ feet No. 3 drill "stuck" in the hole and caused considerable delay, but was finally started again. Meantime the hole in No. 2 went steadily, though rather slowly, in. At 12 o'clock the No. 2 hole had gone in 5 feet 3 inches and the men went up to their midnight supper; the men in No. 3, however, staid at their drills, as they were late in starting.

When the No. 2 men returned to work at 1 A. M. they turned the machine that had been drilling on the centre hole to another hole, leaving the steel in the hole. When No. 3 hole was 4 feet deep the shock of the drill could be plainly felt by holding the hand on the steel in the No. 2 side. The drill-runners were quite frantic with excitement when it became evident that the holes would meet, and when the Tunnel No. 3 drill struck the first light tap against the drill in No. 2 all work was stopped on both sides for a few minutes and all hands ran about, begrimed with smoke and dirt and yelling uproariously. As soon as the drills touched, No. 3 was stopped, and No. 2 starting again in a very few minutes cut clearly into the No. 3 hole. The drills were now withdrawn and the hole thoroughly "blown out" and cleared from dust, after which a light being held up at one end could be seen at the other. The hole appeared almost round and so straight that it was easy to see a man's eye through it when the light was held properly, and this was the first and most striking fact noted by two colored drill-runners, mutual acquaintances, working respectively in Tunnels Nos. 2 and 3. The holes met almost exactly in the centre, each being about 5'3" deep, and the entire

length of the hole being 10'6" as measured by a steel tape passed through from No. 3 to No. 2 by Mr. Wheeler to Mr. Page. It was arranged to pass the battery-wires through this hole and fire both cuts at once, and lots were drawn as to which shaft should have the honor of "firing," which was won by Tunnel No. 2. The side rounds were fired in the same manner, thus opening a passage between the tunnels after nearly three years' continuous and arduous labor.

When it is considered that these tunnels are very wet and that from suspended wires 375 feet long and only 16.5 feet apart the centre line had to be produced 3,100 feet, it will be readily seen that this is an engineering feat of considerable delicacy. The successful culmination of the experiment was made possible by the cordial co-operation and practical assistance of Messrs. McHale and Small, who staid on the spot with the engineers during the entire night.

The dolomite vein above mentioned is believed, with good reason, to be part of the famous Sing Sing limestone, which crops out at the Prison. This is rather interesting, as the vein encountered in the tunnel is over four miles from the Prison and about 450 feet from the surface.

On the 19th inst. the last headings in the "Northern District" met. They were run from shafts 6,400 feet apart, and 270 and 353 feet deep respectively. The horizontal error in alignment was 0.09 foot, in measurement 0.27 foot, and the error in grade was 0.014 foot.

THE COMPOSITION OF HIGH EXPLOSIVES.

THE following interesting list of the composition of high explosives is from *Le Genie Civil* of October 22:

Dynamite—75 per cent. nitro-glycerine, 22 per cent. bone dust.

Dualine—80 per cent. nitro-glycerine, 20 per cent. nitro-cellulose.

Rendrock—40 per cent. nitro-glycerine, 40 per cent. nitrate of soda or potash, 13 per cent. cellulose, and 7 per cent. paraffine.

Giant Powder—30 per cent. nitro-glycerine, 48 per cent. nitrate of soda, 8 per cent. of sulphur, and 8 per cent. charcoal.

Vulcan Powder—35 per cent. nitro-glycerine, 48 per cent. nitrate of soda, 7 per cent. sulphur, 10 per cent. charcoal.

Mica Powder—52 per cent. nitro-glycerine, 48 per cent. mica.

Hercules Powder—77 per cent. nitro-glycerine, 20 per cent. carbonate of magnesia, 2 per cent. cellulose, 1 per cent. nitrate of soda.

Electric Powder—33 per cent. nitro-glycerine. The balance is a secret.

Dessignolle Powder—50 per cent. picrate of potash and 50 per cent. nitrate of potash.

Brugere Powder—50 per cent. picrate of ammonia, 50 per cent. nitrate of potash.

Tonite—52.5 per cent. gun cotton, 47.5 per cent. nitrate baryta.

Explosive Gelatine—89 per cent. nitro-glycerine, 7 per cent. gun-cotton nitrated, and 4 per cent. camphor.

Atlas Powder, A—75 per cent. nitro-glycerine, 21 per cent. of fibreless wood, 2 per cent. carbonate of magnesia, and 2 per cent. nitrate of potash.

Atlas Powder, B—50 per cent. nitro-glycerine, 34 per cent. nitrate of soda, 14 per cent. fibreless wood, and 2 per cent. carbonate of magnesia.

Judson Powder No. 1—17.5 per cent. nitro-glycerine, the rest unknown.

Judson Powder No. 2—20 per cent. nitro-glycerine, 59.9 per cent. nitrate of soda, 13.5 per cent. sulphur, and 12.6 per cent. pulverized canal coal.

Judson Powder No. 3—5 per cent. nitro-glycerine, 64 per cent. nitrate of soda, 16 per cent. sulphur, and 15 per cent. pulverized canal coal.

Rackarock—77.7 per cent. chlorate of potash, 22.3 per cent. nitro-benzol.

Gelatine-Forcite—95 per cent. nitro-glycerine, 5 per cent. cellulose matter not nitrated.

Gelatine Dynamite, A—97.5 per cent. nitro-glycerine and 2.5 per cent. soluble gun cotton.

Gelatine Dynamite, B—75 per cent. nitrate of potash, 24 per cent. of cellulose matter, 1 per cent. soda.

Gelignite—56.5 per cent. nitro-glycerine, 3.5 per cent. nitrated cotton, 8 per cent. wood bark, 32 per cent. nitrate of potash.

Melinite—Picrated acids, cellulose matter dissolved in ether.

Roburite—Nitrated naphthaline and nitrate of potash.

WIRE-GAUGES.*

A CHART was presented by Mr. S. S. Wheeler, Jun. Am. Soc. C. E., showing the different wire-gauges now in use, who stated that there is no serious fault in some of the existing gauges; the sole difficulty is because so many gauges are in use there is confusion. The cause of this multiplicity and confusion is briefly as follows:

First.—The names of the early gauges were confused, the names of makers and of towns being used indiscriminately, and each gauge being known sometimes by one name and sometimes by another.

Second.—The lack of an authoritative standard and accurate tools for duplicating caused the copies made by different firms to differ among themselves.

Third.—A large variety of new gauges of almost every possible nature have been promulgated within comparatively recent years by the men who have worked and written on the subject, as members of committees and individually.

The first two causes of confusion were more or less natural in the evolution of wire gauges, and may be considered unavoidable. The third, the introduction of new gauges, is going on at the present day, and ought to be stopped.

The result of there being no law of formation of these gauges is that among the English gauges there are more than a dozen Birmingham and many "Old English," "Old London," "Warringtons," etc., giving different values for the same number, between gauges of the same name, simply because each maker, having no fixed relation between the sizes to go by, copied some old pattern which was inaccurate from wear. The existence of this nebula of irregular old gauges is the chief cause of the unintelligent outcry against gauges. There is none of that variation between copies of either the Brown & Sharpe or the Latimer Clark, both built upon a fixed rule.

Of the thirty-one existing gauges, the American, or Brown & Sharpe, the one by which copper, brass, gold, etc. (all wires except iron and steel), are measured in America, is the only one that exactly fills the requirements considered. It is a perfect parabolic curve, with a uniform reduction of eleven per cent. between consecutive sizes. The only other gauge which approaches it in the two leading requirements, a range of sizes which covers the wants of wire-users without useless intermediate sizes, and regularity of increase of the sizes, is the Latimer Clark's proposed standard. But this has not been much used, is unfamiliar, and has not been extended in sizes finer than No. 22 American gauge.

The proposition frequently brought out, that the micrometer should be used exclusively, indicates that there is a widespread failure to realize what the wire-makers want. The majority of manufacturers have neither the time, skill, nor need for the micrometer. They want a rough notch gauge adapted to sorting out the sizes which they draw, and as simple and as easy to read as possible. There is no use in recommending or condemning the micrometer. It is used, and, notwithstanding any condemnation, will continue to be used in all accurate work, as it is indispensable.

The detailed description of chart was listened to with great interest. Mr. Metcalf followed by stating that in the works he was connected with the micrometer was in general use for all grades of work, and the workmen preferred it to any other.

ABATTOIRS IN THE UNITED STATES.

AN English correspondent inquires for any publications giving reports on this subject. The following is all that is known to us, though possibly some of our readers can suggest something new.

[Probably the only public abattoir (in the European sense of the term) in this country which has any special interest is that in the city of Boston, known as the Brighton Abattoir. See

1. Report Board of Health, State of Massachusetts, VI., 1875, p. 187; also Vol. V., 1874, p. 155.

2. The Brighton Abattoir, owned by the Butchers' Slaughtering and Melting Association. 8vo. Boston, 1878. (Text English and French.)

3. American Public Health Association Report, Vol. VI., for 1880. Boston, 1881. p. 217-231.

These books can probably be seen at the Parkes Museum of Hygiene in London.

The large private slaughtering establishments in Chicago, Cincinnati, etc., have never been properly described or illustrated.]

* Abstract of paper read at the November 17 meeting of the American Society of Civil Engineers.



SOME SKETCHES OF PLUMBING IN THE
RESIDENCE OF WILLIAM F. WELD, ESQ.,
BROOKLINE, MASS.

No. II.

(Continued from page 712.)

WATER-SUPPLY.

A FEATURE of the water-supply of this residence is two water-tanks, one at a higher level than the other. The difference of level is not a matter of choice, but of necessity, as one, the upper tank, is in the attic of the main building, while the lower one is in the attic of the extension which contains the laundry, etc.

All the fixtures in the house can be supplied from the upper tank, and all fixtures in the lower part of the house can be supplied from the lower tank, but at a reduced

board supply bath-room and water-closet, etc., upstairs. The second pair of cocks on the switch-board supply the laundry and servants' quarters when necessary. The third pair of cocks, the lavatory, and water-closet, etc., in the lower part of the house, and the lower pair of cocks, the milk room, and the servants' dining-room; the manner of supplying the kitchen being apparent.

A study of the diagram shows how the pipes H and C, corresponding to the second pair of faucets, may be followed to the laundry. They run direct to the end of the wash-trays and return with Y-bends into the lower ends of the laundry supply. The faucets shown both in diagram and in laundry just above the Y-bends are kept closed when the laundry-boiler is in use, but should it be necessary to use water from the kitchen-boiler in the laundry, they are opened and the lower tank shut off. In the diagram, the valves to shut the lower tank off is shown below the branch to servants' bath, etc. This is a mistake, as they should be above. To the practical man a study of the diagram will show other combinations in which the water from the low tank may be admitted to parts of the front building when the high-tank service is not in use, by the manipulation of the switch-board valves, etc.

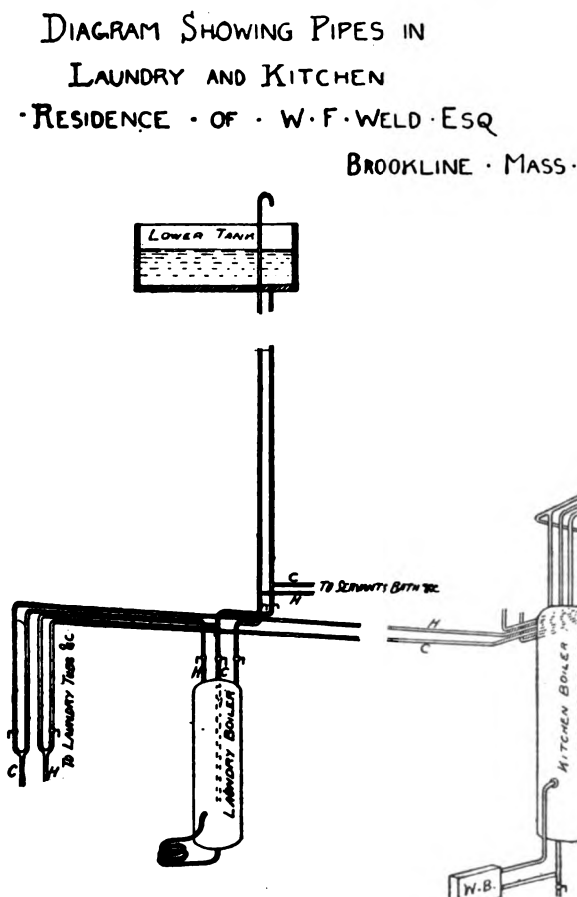


FIGURE 4.

pressure. The object of separate tanks, however, is to admit of a water-supply in the servants' quarters and laundry when the other part of the house would be unoccupied, as, say, in winter time, at which time the water-pipes, etc., would be drawn off to prevent freezing and the traps filled with glycerine or some non-freezing mixture. The arrangement, however, also admits of using different waters in different tanks; for instance, well or city water in the high tank and soft water or cistern water in the low tank for laundry.

The diagram, Fig. 4, shows this arrangement of tanks and pipes in principle, and is, so far as the kitchen and laundry pipes are concerned, an exact reproduction of the pipes of the house, as may be seen by a study of the kitchen and laundry illustrations, Figs. 5 and 6. Like letters in different figures have reference to the same pipes when seen again.

To trace the cold-water supply from the upper tank we follow the pipe C on the right of diagram, Fig. 4. It is also to be seen in the kitchen on the ceiling. This pipe goes to the switch-board in kitchen, forming the right hand or cold line of supply to all parts of the house.

The second pipe from the bottom of the upper tank supplies the kitchen-boiler direct. From the boiler the warm-water pipe H runs to the kitchen-sink in one direction and to the left-hand side of the switch-board in the other direction. The two upper cocks of the switch-

The general arrangement of the kitchen can be seen in Fig. 5. The floor is oak. The wainscoting behind sink marble. The part behind the switch-board white-glazed tiles. The walls are oil-painted. The chimney-breast is of white-glazed bricks. The sink is of soapstone, supported on oak frame, with brass legs. The boiler is eighty gallons capacity, extra heavy.

The laundry boiler is forty gallons capacity and is connected to a separate stove and coil. A separate open boiler for boiling clothes, etc., is also used, as shown in the corner. This arrangement, the convenience of which is obvious, is peculiar to the vicinity of Boston. The

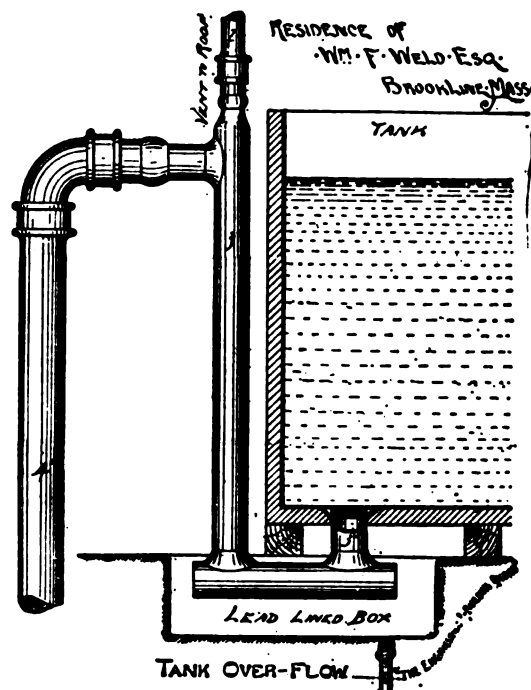


FIG. 7.

arrangement of the tubs, which are soapstone, is shown. The waste-pipes are lead and a casual look gives the idea of more connections than there are tubs, but this is explained by the fact that the supports or hangers from the bottoms of the tubs are made to correspond to the waste-pipes in appearance.

The walls are glazed bricks and the floor buff tiles.

Figure 7 is a detail of the overflow-pipes of the tanks first described, and as the pipes are all marked it requires no special description from us.

CORRECTION.—In the first article on this work, published in our last issue, we were in error in stating that the drainage is to the city sewer. It is to a system of sub-surface disposal laid out by Messrs. Aspinwall & Lincoln, of Boston.

(TO BE CONTINUED.)

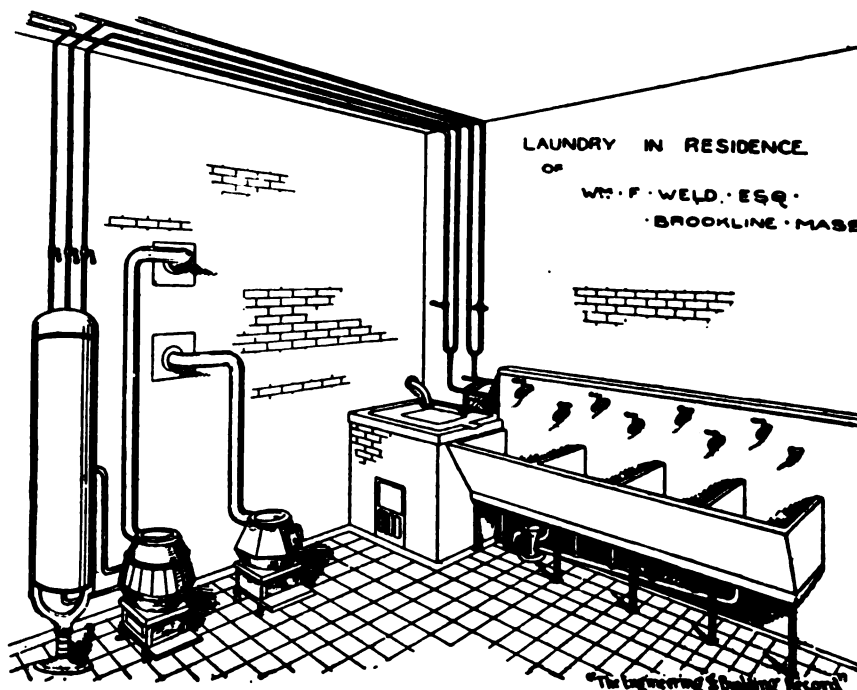


FIGURE 6.

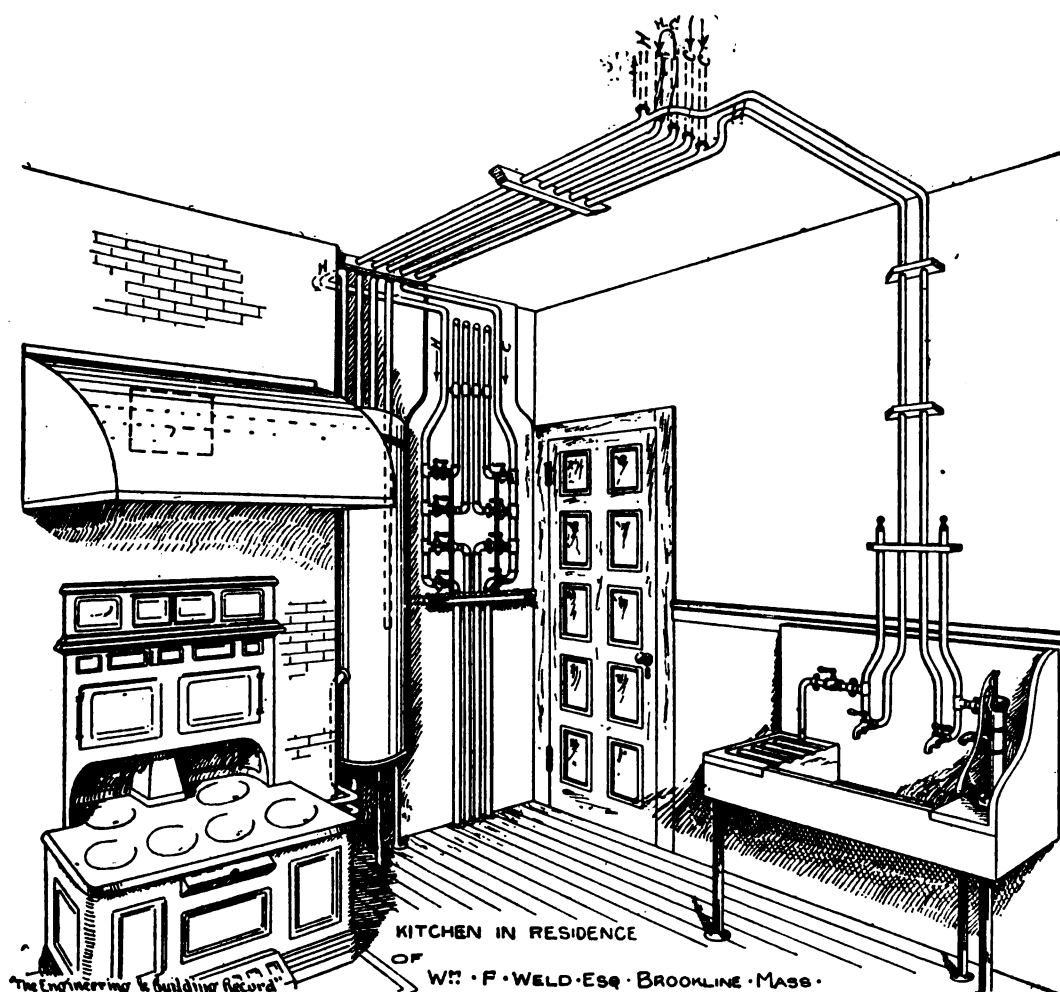


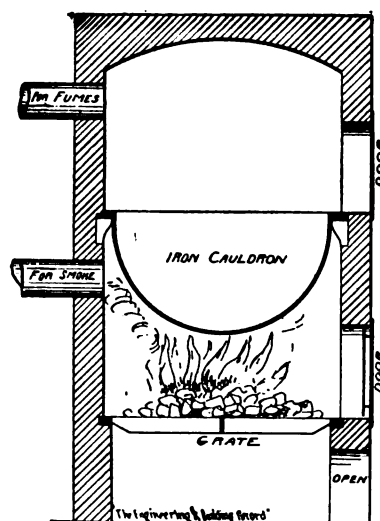
FIGURE 5.

MAKING VERSUS BUYING SOLDER.

SIR: We have always found it better and cheaper to make our solder than to buy it.

We have saved twenty to twenty-five per cent. in the cost of manufacture, and have had a solder that would hold its own until all used up. The solder we have bought has always turned up "coarse" after a few heats of the pot. We have always kept the weight of the tin and joints, and know how much solder we made.

Here is one sample: 202 pounds "Straits" tin melted with 500 pounds solder-joints (cut out) made 656 pounds solder.



BRICK FURNACE FOR MELTING SOLDER

This solder is far superior to any we can buy. In regard to the trouble you speak of about the purity of the joints, we heat the old joints in a large iron cauldron set in a brick furnace. I enclose sketch. When the metal is red we put in a stick of sulphur, which, when stirred in well, purifies the metal. Add your tin, and try making a joint before running off the metal.

Respectfully, W. G. N.

A SEWER STOPPED BY TREE ROOTS.

OUR Milwaukee correspondent reports a case of the roots of a tree stopping up a sewer, which was found by a Milwaukee plumber last week. Being unable to clear the sewer from the cellar, it was dug up outside and found

choked up solid with tree roots. The roots were matted together and made a very solid mass. The sewer is made of cement pipe and was laid wrong end to—i. e., with the hub ends toward the street. The sewer was only six feet deep and the joints were not made perfectly, some being only half cemented. The roots extended out into the street and for a distance of 40 feet into the house—i. e., 40 feet from curb. The roots were both inside and outside the sewer and followed it in the trench for 20 feet inside the cellar.

THE NEW SECRETARY OF THE NATIONAL ASSOCIATION OF MASTER PLUMBERS.

NATIONAL ASSOCIATION OF MASTER PLUMBERS
OF THE UNITED STATES,
OFFICE, 54 UNION SQUARE,
NEW YORK, November 22, 1887.

SIR: In accordance with the resolution of the National Convention of this Association at Chicago, the Executive Committee has appointed Mr. John C. Welch, Grand Secretary, with his office at 54 Union Square, New York City.

Mr. Welch will have charge of the correspondence and he will be pleased to hear from and communicate with the members and friends of the association on all subjects pertaining to its prosperity and usefulness.

Yours truly, JOHN BYRNS, President.

Gas and Electricity.

Illuminating Power of Gas in New York City.

Week ending	New York Gas-Light Company.	Manhattan Gas-Light Company.	Metropolitan Gas-Light Company.	Mutual Gas-Light Company.	Municipal Gas-Light Company.	Krickerbocker Gas-Light Company.	Equitable Gas-Light Company.
November 19	24.82	20.06	22.12	28.00	29.47	24.80	30.85

Correspondence.

PREVENTION OF FIRES IN THEATRES AND PUBLIC BUILDINGS.

In response to request for information on this subject (see item, page 712, issue of November 19), as regards Boston and vicinity, we have received the following from Mr. C. J. H. Woodbury, M. Am. Soc. C. E.:

"BOSTON MANUFACTURERS' MUTUAL FIRE INSURANCE CO., 31 MILK STREET, BOSTON, November 19, 1887."

"SIR: The United States, State, and city buildings in Boston are protected by stand-pipes with hose at each

story and fire-pump in the basement. They are also furnished with a large number of portable extinguishers. The hospitals have special yard hydrants and stand-pipes, all of them supplied by city water alone without the addition of any pump. The school-houses are provided only with extinguishers. These buildings are also provided with what are called special boxes connected with the fire-alarm.

"The theatres are protected with special hose and extinguishers, and a fireman in full uniform is detailed on the stage at every performance. Over the stages of two theatres there are automatic sprinklers, and over some of the stages there are skylights, with wire netting below, for the purpose of affording relief from smoke which would be drawn over the stage and away from the auditorium when the glass is broken by a slight fire. One theatre has an iron curtain and another a curtain of asbestos; all doors open outward, and the number of doors and other precautions are added according to the discretion of the inspectors of buildings. The theatres are swept after every performance as a precaution against matches or any other dangerous matters, as well as for the orderly conduct of the theatre. There is also a special electric connection to the fire department without striking a public fire alarm.

"I believe that automatic sprinkler protection over the scenery and store-rooms of every theatre is a precaution which ought to be required by law. In the industrial property insured by this company their use has been followed by results which are producing an economic revolution. We had last year ninety-nine fires put out by such apparatus, with an average loss of less than two hundred and fifty dollars, while the average loss of fires to date starting under the Grinnell sprinkler has been a little more than a hundred dollars, that being more sensitive to heat than other types of sprinklers.

"The result of this improved protection has diminished the cost of insurance in the Mutual companies about three and one-half million dollars during the last eight years. The average cost of fires starting where there is no automatic sprinkler protection is about seventy-five hundred dollars. If I can provide you with further information upon this point, let me know, and I will be very happy to comply with your request if in my power.

"Yours very truly, C. J. H. WOODBURY.
"Second Vice-President."

EFFECT OF TEMPERATURE ON TRANSVERSE STRENGTH OF IRON AND STEEL.

SIR: Mr. Ramsey's letter in THE ENGINEERING AND BUILDING RECORD of recent issue introduces a subject to which few, if any, structural and inspecting engineers have not given some consideration, and further discussion seems desirable. That tool steel or any steel high in carbon, or perhaps manganese, is vitally affected by temperature changes below (say) 60° Fah., seems incontrovertible. Every iron erector will verify the cold-chisel illustration, and doubtless many steel rails, which are so generally of high steel, are much indebted to low temperature for their breakages; but all of my own experience and observation is that properly worked, clean wrought iron or low steel, free from impurities, experiences little, if any, effect from the climatic temperature changes in this country. The 12-inch channel tests mentioned have merely the weight of a not remarkable coincidence: the breakage of the channel in the field may not have been surprising. No data are given, but if the piece was a 12-inch 30-pound channel, 30 feet long, and fell the 10 feet and struck on its centre, flatwise, the strain of flexure alone would have been 81,000 pounds total, — 9,000 pounds per square inch, uniform, or 22,000 pounds per square inch at outer fibre, but these results should be doubled for the suddenly applied load, so that without considering the violent destructive effect of impact we have conditions of breaking which, of course, increase or decrease directly with variation of the assumed from the actual weight and length. I have had a perfectly good 60,000 or 70,000 pound steel angle, 3½x3½x50-feet, break by flexure in a warm shop, simply by being gently lifted by a sling at the centre.

A channel, too, is a most undesirable section. Everyone knows of the initial strains necessarily existing in it, its warping on the hot bed and restoration (?) by the gag press; and, as in every piece of piled iron, there is the chance of old rails, and the certainty, in case of a channel, that the material of the web is different from that of flange.

These considerations make results of tests of specimens cut from same bar always likely to vary, and contradictions probable.

The nicked test of iron is an uncertain criterion; a piece broken after nicking with a dull chisel often develops a crystalline fracture, when an adjacent piece nicked by a sharp chisel does not. Low steel (0.15 per cent. carbon) is essentially a pure wrought iron, and the better the latter becomes the closer the identity. In hundreds of tests made within the last two years on Bessemer and Clapp-Griffith structural steel up to about 0.18 C., I have

noticed no indications that they were affected by differences of temperature. In bending 90° to 180° about a small radius, a thick piece of iron or steel develops enough heat to almost burn the naked hand, therefore the internal condition must speedily become independent of external temperature. Most important is the fact that in perhaps 500 cases where pieces of the same specimen of low steel were bent, both naturally and after heating to cherry red and quenching in water of 60° to 70° Fah., there not only was no decided difference in results, but it was even apparent that a variation of 40° in the temperature of the water, or in that of the steel from a dull red to orange, had no appreciable effect.

Bending and breaking tests, whether nicked or not, depend vitally on the skill and carefulness of the experimenter, and it is to his ability, rather than the specifications, that attention should be directed; for while a good test can hardly be secured from bad material, very bad tests may easily be got from good material, and it is believed by many observers that in very many cases of fracture by nicking and impact, the structural appearance is not that originally existing, but has been induced by the applied forces and conditions at moment of fracture—i. e., the texture or crystallization is not the cause, but the effect.

In this connection I beg to enter protest against sledging-tests, believing that, with the proposed impact test, they are unjust, illogical, and useless, by no means indicative of the qualities sought; no simple material or trussed structure should be subjected to parallel conditions in actual service, and if, as is generally alleged, the point desired is evidence of its ability to undergo shop manipulation, it would be better, easier, and cheaper to specify punching or shearing tests. There should undoubtedly be a prescribed standard for length of arc and manner of bending test pieces. Sledged bends, either by direct impact or intermediate contact, are brutal; bending under a steam-hammer is variable even when accomplished by weight pressure alone, much more so when effected by repeated blows; bending by pressure into a die or between supports is hardly better.

The most simple, reliable, and uniform method is by confining one end of specimen by a back stop, and with radial arm and friction roller contact bending the other end around a centre pivot with collar of diameter required for inside of curve.

The conditions of speed and train load do, and doubtless should, remain constant for the same structure throughout the varying temperatures of the year, and I am not aware that special precautions are observed on Canadian or North-western railroads, or that accident and destruction has occurred to their bridges as often as to some in warmer latitudes.

Nevertheless, when the imperfect seats, poor alignment, open rail-joints, effect of curves, and above all, the violent blow from every revolution of a flattened wheel is considered, there is sufficient reason for prohibiting high speeds at any time on any structure, unless it be a solid girder of excessive rigidity and fractional unit strains.

FRANK W. SKINNER.

THE ARCHITECTURAL DESTRUCTION OF NEW YORK CITY HALL AND PARK.

NEW YORK, November 17, 1887.

SIR: I am so pleased with your remarks in your issue of November 12, and so shocked at seeing the sketch which you give of the proposed additional buildings in the City Hall Park for the criminal courts, that I cannot allow the opportunity to pass without entering my protest against the desecration.

Morris wrote, "Woodman, spare that tree!" Can we not, with ten times the feeling, write: "City officials, spare our park! spare our City Hall!"

It seems to me, if the design is carried out as suggested, our beautiful City Hall will become a monstrosity. It cannot be made much else.

Just imagine buildings being put there in such close proximity to the Hall when we have so little left of our park. It was bad enough to build the Court-House where it is, far worse to build the brown stone engine-house, and to sell the lower end of the park for a United States Court-House, but all these pieces of stupidity pale in comparison with this project.

Here we are about to spend \$8,000,000 to \$10,000,000 for parks in the upper wards, and \$1,000,000 to \$2,000,000 for small parks in the lower part of the city, and yet our Mayor, who is so sensible about many things, lends his voice for curtailing the little there is left of the only park below Washington Square, save the Battery.

There would be some excuse if our prison was in the park, for it and the Court-House should be near each other, or if we did not own a block opposite the prison exactly suited for the purpose. Can we not arouse public sentiment enough to cause our officials to pause and leave us, in its beauty, our City Hall? for, old as it is, it is a most beautiful building, and reflects great credit on its designers, and we in these later days should not allow dollars and cents to blot out all our sense of the beautiful and good.

Yours truly, HUGH N. CAMP.

THE WATER-WORKS CONSTRUCTION CRAZE AT HELENA, MONTANA.

MR. T. C. POWER, of Helena, Montana, General Manager of the Benton Transportation Company, writes us regarding water-works construction in that city as follows: "Helena, Montana, has been running wild for the last thirty days in the construction of water-works. Three companies have been digging ditches throughout the city, and in one street the three ditches, representing each company, are paralleled. George F. Woolston, representing the new company, has laid about twelve miles of pipe and is working 700 or 800 men. The Helena Water Company has extended its mains and has laid nearly four miles of pipe. Mr. Chesman has laid about two miles of pipe. The Helena Water Company and Mr. Chesman have the gravity system, with more than enough of water to supply a city twice as large as Helena. The Woolston scheme has been to sink wells, and they expect to pump their water to an elevation of about 450 feet. This will cause a great outlay of money continually. The outcome can be easily determined by any sane man. They have, after working hard since last June, at great expense, succeeded in getting about five or six hundred thousand gallons per day from their well—not sufficient by a third to supply their pipes. This is a true statement of the Helena, Montana, water-works industry."

MACHINERY FOR MAKING SEWER-PIPE WANTED.

VICTORIA, B. C., November 14, 1887.

SIR: Could any of your readers favor me with the address of a firm who manufacture or sell machinery for making sewer-pipe? Yours truly,

SAMUEL C. BURRIS, Architect.

THE FALL OF FIVE DERRICKS AT THE NEW COURT-HOUSE, BOSTON.

WE have received the following letter from one of the Commissioners for the Erection of a New Court-House for the county of Suffolk:

BOSTON, November 22, 1887.

SIR: I have just noticed your diagrams, etc., and read the report of the cause of the falling of the derricks at the new court-house site, which is *not correct* in some particulars, and which will be more satisfactory to you to have corrected. The support to the cross-timbers was placed about two feet to the left of the mast, not directly under it, as shown, and the weight of load added to that of the derrick tilted the left arm of the cross-timbers, so that the support and one wall took the load, and was not sufficiently rigid to overcome the leverage of weight at the end of the boom. Had there been a 3x4-inch joint used to brace the support in line of cross-beams, no accident would have happened (probably).

Respectfully yours, THOMAS J. WHIDDEN.

FOURTH ANNUAL CONVENTION OF THE WESTERN ASSOCIATION OF ARCHITECTS.

(Special Correspondence.)

WEDNESDAY, Thursday, and Friday, November 16, 17, and 18, 1887, were great days among those members of the Western Association of Architects who attended the convention of their society held at the Grand Hotel, Cincinnati, where the committees had headquarters, and the spacious corridors of the "parlor floor" afforded room for a large and fine display of architectural drawings.

At 11 o'clock on Wednesday morning, in the large convention room of the hotel, President John W. Root, of Chicago, called the association to order and read an opening address, which, if space permitted, we should like to reproduce in its entirety. In reference to the much-discussed question of professional ethics, Mr. Root said:

"Each must have most nearly at heart the interests of all, and must be prepared, at any time, and for the ultimate good of all, to surrender small and temporary personal advantages. We are all in this Union upon a level plane. The heads of some may tower above, but the feet of none may stand below those of their brethren.

"This being true, as a matter of theory, how shall it be realized as a matter of practice?

"First, let us answer, by cultivating among ourselves relations of perfect understanding and friendship.

"Men are so largely influenced by personal ends that no relation can ever be established so ideal in its common help and consideration as that existing between two friends; and I am persuaded that, out of any ten of the grievances one of us may in professional practice have suffered from another, nine will be found directly traceable to misapprehension and consequent estrangement.

"The short way to avoid these grievances is to cultivate such warmth of personal relationship that no man of us need for a moment hesitate in any case of doubt or possible distrust to ask of his friend full and free explanation. Once this state of affairs is brought about our code of ethics unites and enforces itself, and until it is brought about any code of ethics is inadequate."

Mr. Root went on to say:

"The thing to insist upon is thought, not dexterity of pencil or newness of fad, but full expression of one dominant and well-thought-out idea.

"Idea is the crying need of our modern architecture. * * * Architecture is the material expression in stone and iron and brick of an idea dominating, consistent, coherent. * * *

"Be it ours, therefore, to infuse into our work, that earnest thought which will make it lasting."

After the opening address came the reports of various committees.

Mr. Sullivan, chairman of the committee appointed to effect certain alterations in the code and to devise means of maintaining an elevated standard of membership, read an excellent and practical report.

This committee had prepared a blank to be filled out by the applicant for membership, giving name, place, etc., with the name and address of three architects and three men of good standing outside the profession willing to answer the questions on a printed form to be forwarded by the examining committee. These answers to be regarded as strictly confidential. Only such questions will be asked as are necessary to ascertain that the applicant is a man of honorable character.

The applicant must also inclose with application three photographs of buildings erected by him, giving location of each and name and address of owner and contractor.

Before admission an opportunity will be given to members to object to any candidate, such objection to be made the subject of careful private investigation by the examining committee.

The Committee on Statutory Revisions recommended renewed efforts to secure the adoption of an enactment similar to that presented at the St. Louis Convention for the regulation of the practice of architecture, and proposing a radical reform in the erection of the buildings of the National Government.

A long report was received from the Committee on bill governing the office of the Supervising Architect in the U. S. Treasury Department, which was accepted and ordered printed in full in the report of the convention.

Wednesday afternoon was given up by the association to a long drive through the various suburbs, and to viewing the principal objects of architectural interest in and around the city. The convention reassembled at 11:15 A. M., on Thursday.

The Treasurer's report having been received, and also that of the Committee on Metrical Measure, and one ordered upon the subject of uniformity in contracts and specifications, Mr. D. Adler proposed the consideration of the consolidation of all the architectural associations, and a committee of five, including the president, was appointed for that purpose, to co-operate with the committee of the American Institute.

The members of this committee are: J. W. Root, D. Adler, George B. Ferry, W. W. Carlin, A. Van Brunt, and a report was ordered to be made by the 1st of August, 1888. Then followed balloting for new members, when eighty candidates were presented, and this having been disposed of the following officers were elected:

President, Sidney Smith, Omaha, Neb.; First Vice-President, J. S. Alexander, Lafayette, Ind.; Second Vice-President, W. C. Smith, Nashville, Tenn.; Secretary, N. S. Patton, Chicago; Treasurer, S. A. Treat, Chicago.

Board of Directors: J. W. Root, Chicago; W. R. Forbush, Cincinnati; J. V. Flanders, Chicago; C. F. Schweinfurth, Cleveland; George B. Ferry, Milwaukee, Wis.

The President-elect, Sidney Smith, was the unanimous choice of the nominating committees. He was a pioneer in the association, and is a member of the Royal Institute of British Architects.

On accepting his re-election to the office of Treasurer, Mr. S. A. Treat made the following pithy speech: "Membership dues for 1888 are now payable."

A vote of thanks to the Art Museum for courtesy in extending an invitation to visit it, and also to Messrs. G. K. Shoenberger, A. R. Vail, and Alex. McDonald for opening their private residences to the association, was next in order. A resolution on the death of Thomas U. Walter, late President of the American Institute, was also passed, and a vote of thanks was given to the Commissioners of the Exposition.

The convention adjourned to meet next year at Chicago.

The papers read will be noticed in subsequent issues.

THE PARAMOUNT REQUIREMENTS OF A LARGE OPERA-HOUSE.*

OUR secretary has requested me to submit a paper upon "The Paramount Requirements of a Large Opera-House or Theatre as regards site, construction, disposition of space, day and night illumination, arrangements for water-supply, ingress and exit, heating, ventilation, hygiene generally, and provisions against conflagration, etc."

The following is an effort to comply with this request:

As we are all American practitioners whose work is confined within the geographical limits of the United States and therefore within the financial and other limitations arising from our National peculiarities, I will make no effort to describe the ideal large opera-house, of which so many examples exist in Europe, but will confine myself to the essentials and peculiarities of an American theatre and opera-house containing upward of 3,000 seats and capable of serving also as a concert or convention hall.

The site of our building should be an open square surrounded by broad streets; but in no case should a site be chosen which does not permit the disengagement of the building on at least three sides.

The construction of such building should be of the most solid and enduring materials, so disposed as to produce a building as nearly fire-proof as modern science and art can make it. The ever-changing conditions of desirability of location so characteristic of American cities must be disregarded by making stability and permanence of structure paramount considerations.

In the disposition of space we are confronted by limitations which prevent the fulfillment of ideal requirements. Municipal aid is with us never extended to the builders of an opera house, which must therefore be erected by private capital, of which it seems impossible to secure as much as is required for erection and maintenance without connecting therewith some means of commercial utilization, so that a revenue sufficient for the maintenance of stage and auditorium during the many periods of disuse may be obtained.

This disposition of important parts of the ground, generally the street frontage, increases the difficulty of planning the lobbies, foyers, and corridors so desirable for a structure of this kind; but whatever the wants or necessities of the commercial adjuncts of such building, there should always be lobby space enough to hold almost the entire audience.

In determining the space to be assigned to the stage, it must be remembered that without suitable provision for presenting to the public scenic and dramatic effects on a far grander scale than can be produced in the ordinary theatre or opera-house, there would be no justification for the existence of a building of the class which I am endeavoring to describe. And yet, too much space should not be assigned to the stage, as the commercial result of the enterprise must be kept in mind, and this requires a reasonable proportion between the cost of producing a good opera or a spectacular theatrical performance, and the size of the audience which can be drawn to see the same. We have no subsidy from municipal or general government to make good deficiencies which would arise from the cost of performances given upon a stage of the proportions, as compared with auditorium found in the opera-houses of the old world. Besides, we cannot in any city of our country maintain, still less carry with a traveling company, a permanent well-trained chorus, corps de ballet, or a corps of trained supernumeraries sufficiently large to fill a stage approximating in size that of a European house of the first rank.

A very large space should be assigned to the mechanisms for the production of scenic transformations and illusions. Nothing is more annoying to American audiences than the excessively long waits between acts so characteristic of operatic performances on a large scale as we know them on the American stage. And while the almost magic transformations characteristic of the stage of the Madison Square Theatre are impossible of attainment under ordinary conditions, I believe that a happy mean can be found between these and the evil before referred to. One of the means of securing this end would be an effort to keep all moving and movable parts incidental to the production of scenic effects, transformations, etc., within reasonable bounds as to size and weight, and, as far as possible, to make transformations by upward and downward movement of the stage paraphernalia, by which means the horizontal dimensions of the stage can be minimized, although great depth below and height above the stage floor would become essential. Liberal allowance of space for dressing-rooms, and for storage of scenes, properties, and costumes must not be forgotten.

It is advisable to endeavor to secure at least partial sunlight illumination of the house, and thus avoid the expense of artificial illumination for daily cleaning, rehearsals, and for daylight assemblies, such as conventions, mass meetings, concerts, etc., when scenic effects are not to be produced. This daylight illumination will be almost invariably imperfect for corridors, lobbies, etc., and in many instances the business adjuncts of the building will cut off all means of illumination except skylights, and these can rarely be made sufficient to light up all parts of the house. Means must be provided to shut off, when necessary, all sunlight which might interfere with the realization of scenic effects.

Day and night illumination of the auditorium and stage when occupied for a scenic representation of any kind must be by artificial light. Of the artificial lights known to us, the incandescent electric-light is the only one to be

seriously considered, in the design and distribution of which every effort should be made to secure a uniform and general illumination—a lighting up of all shadows under galleries, and an illumination which will reveal clearly all faces and toilets without bringing them into a trying glare. In arranging the lights of the stage, it is necessary to see to it that the light falls upon the faces of the performers in such manner that there will be no shadows which produce distortions of their features. It is well, also, in arranging lights, particularly those on and immediately in front of the stage, to interpose reflecting surfaces which throw the light where it is required, and shut out its glare from the direct line of vision of the audience.

In the construction and laying out of the engines, dynamos, and wiring for electric-light, an effort should be made by suitable subdivisions to prevent the possible putting out of all the lights by an accident to the machinery or wires. The practice of European theatres in providing as a safeguard for such a contingency a system of oil lamps or wax candles arranged and always kept burning around the walls of the auditorium and in all the corridors is worthy of imitation.

The means of ingress and egress should, of course, be ample. No allowance less than three feet for every 200 persons in determining the width of aisles, doors, and stairways should be considered. A large number of narrow aisles is to be preferred to a small number of wide ones. Aisles should lead as directly as possible to doors. As before stated, the corridors and lobbies should be of sufficient size to hold more than one-half of the audience. The stairways must have frequent landings and the exits should be so disposed as to tend to disperse the audience as rapidly as possible.

Where audiences are very large the means of ingress become quite important, and every facility must be extended to those who purchase their tickets at the beginning of a performance, and these should be kept out of the way of persons who come already provided with tickets, and every means must be used to facilitate the entrance of the public into the building, and to prevent blocking up of halls, corridors or stairs.

Heating and ventilation present unusual difficulties in a house of this kind. No dependence whatever can be placed upon doors and windows. The air must be warmed in winter and cooled in summer. A sufficient volume of air for comfort and for health must be forced into and removed from the room by mechanical means. The temperature and hygrometric condition of the air admitted must be under perfect control, and the means for exhausting the air must be so arranged that the vitiated air in its progress to the exhaust ducts does not come in contact with the heads of any part of the audience and that "draughts" are prevented. It is desirable for acoustic effect to have all air-currents tending from the stage outward. It will be easiest to attain these ends if the fresh air is chiefly introduced at and from the top and in greatest volume near the stage, and if the exhausts are in and near the main floor and in and near the floors of the various galleries and balconies, increasing in capacity with their distance from the stage. One-third of the air-ducts should open on the stage, but these ducts must be under the immediate control of the prompter, so that they may be closed when smoke is produced on the stage and while the curtain is lowered and turned on again as the curtain is raised.

Wherever possible the galleries should be disengaged from the walls behind them so as to permit the free passage of air-currents through the space covered by the gallery.

As a protection against draughts from out doors, there should be, if possible, at least four sets of doors between the chief lobbies and the outer air, and each of the spaces enclosed by these doors should be warmed.

The means of cooling the air for summer ventilation must be refrigerator machines. It is impossible to handle successfully a sufficient quantity of ice for our purpose. In dusty and smoky cities, an apparatus for washing the air before it is introduced into the building should be provided.

As it would be too expensive to call into use the means of heating provided by the ventilating system for the daily cleaning of the house and for rehearsals, there should be a sufficient quantity of direct radiating pipes and coils on the stage and in the auditorium to warm the house to a moderate extent. These would not be used when the house is occupied by an audience, except perhaps in the coldest weather.

Foremost among the necessary hygienic arrangements is the system of ventilation before described. Next in order are the plumbing fixtures and pipes, upon which even greater care must be expended than in ordinary buildings. During the periods of disuse to which houses of this kind are subject, the evaporation of water from the traps, or syphonage of traps, or leaks of soil or waste pipes would produce most disastrous results. These contingencies must be therefore guarded against with the utmost care. During these same periods of disuse in winter the danger by freezing of water in the pipes is a danger against which precautions must be taken.

The provisions against conflagration are a most fruitful topic. As it has been assumed that the general construction of our house must be fire-proof, we have in this already a most potent safeguard against conflagration. If we carry this fire-proof construction further and use for the frame-work of the stage, stage mechanisms and paraphernalia, incombustible materials and banish gas from the stage entirely, using only electric-light not only for white

light, but also for the effects of colored light, we shall have eliminated entirely the danger of disastrous conflagration from our house. It will, however, be impossible to avoid entirely the use of canvas for scenery and the use of wood for the lighter and more temporary accessories of stage setting, and the large quantities of costumes and properties which accumulate about such a house are necessarily combustible. While a fire among these cannot be considered a menace to the structure, still there should be means at hand for readily extinguishing it; there is a choice, such as a system of automatic sprinklers or the thorough training of the stage attendants in the use of water in the tanks and pails, in the use of hand-pumps, hand-grenades, chemical fire-extinguishers, etc.

But although the building be indestructible by fire, and although the gathering of headway by a fire is almost absolutely guarded against, alarms and frights may arise which in so large an audience would have serious consequences. A strong drop-curtain of incombustible material used daily, so as to be always in readiness for instant use in an emergency, will shut off from the view of the audience the accidental burning on the stage of small pieces of scenery, etc., as may have been left unprotected. A very large and high smoke-duct above the stage, the valve of which is connected with the prompter's stand will permit the immediate and rapid escape of smoke produced by such fire, or by the use of firearms, etc., on the stage.

It is safe to assume that an audience in a house of this description is absolutely safe from fire; that is, that no combination of circumstances can arise by which any member of the audience can be injured in life or limb directly by the effects of the fire. There always exists, however, an element of danger in the liability in large assemblies to become panic-stricken and uncontrollable. The general solidity of construction and general safeguards against fire mentioned before will do much toward preventing the formation of a panic in the audience. Arrangements for averting the danger of the going out of all the lights in the house will eliminate another serious possibility of panic and danger.

The foregoing provides sufficiently for the safety, comfort, and health of the audience; but all of these will be as naught unless the acoustic properties of the house are such as to permit the easy and distinct transmission of articulated sound to its remotest parts. The suggestions given under the head of ventilation will be one of the means necessary for securing this end.

In addition to this, it should be said in a general way, that in the construction of the banks of the seats Scott Russell's isacoustic curve should be adhered to as far as practicable; that, wherever possible, resonant materials should be used in the construction and facing; that large, hard, smooth surfaces should be avoided; that walls and ceilings should be well broken; that the width and height of the house should be least at the stage, and that these dimensions should be increased with the distance from the stage, and that all our measures should tend toward the reduction to a minimum of the volume of air to be set in motion by the voices of speakers and singers; also to such arrangements of surfaces as will tend to direct the sound waves toward the audience, and such control of the air-currents as will prevent the dissipation of sound-waves in space.

I will add, in this connection, that a comparatively low proscenium and not excessively wide opening is desirable as one of the first conditions of this system of construction for acoustic effect. If it is intended to use the house for conventions, or concerts by mammoth choruses, the proscenium opening may be so constructed as to leave its width adjustable at pleasure, and a temporary ceiling may be suspended at or near the level of the crown of the proscenium arch over the stage, and hung with a downward slant toward the back of the stage.

As I have said before a modification of Scott Russell's isacoustic curve should be used in laying out the banking of the seats. This modification is for the purpose of obtaining an isaoptic line and consists in shifting the level of the focus to which the curves are drawn from the level of a speaker's mouth to the floor line at the foot of the stage, and in substituting for a single focus to the middle of the stage, foci tending toward the sides of the curtain opening for the respective sides of the house, so that the focus of the curve for the seats nearest any one side is at a corresponding jamb of the curtain opening.

It may not be always best to follow the foregoing absolutely for the selection of foci in isacoustic and isaoptic lines, but the deviation should never be great and the nearer the approach to these conditions the easier will be the sight lines for all occupants of the house. It will be found as one of the effects of an adherence to the foregoing that long, wide side galleries must be banished.

As Mr. Bloor has well said in his letter requesting this paper, "Style is generally conceded to be a matter of taste, chiefly dependent on education or temperament, environment of fashion, or on a combination of these. I have not included it under paramount requirements, but it is nevertheless the crowning element of an edifice in its relations with the contemporary public and with posterity and history." And I will say upon this head only this, that the general proportions in materials of construction of such a building as this justify a general simplicity and demand the utmost dignity of treatment. This simplicity should, however, not become baldness, nor should the poetic element be excluded from the design.

* Paper by D. Adler, read at Annual Convention of American Institute of Architects, Chicago, October, 1887.

THE MILWAUKEE DRAW-BRIDGE.

THE 205-foot span double-track draw-bridge at Milwaukee was designed and built for the Chicago, Milwaukee and St. Paul Railroad by the Edgemoor Iron Co. While having neither extraordinary features nor unusual span, it is an example of carefully-finished design and excellent arrangement in most recent practice.

The link connection at centre of top chord secures perfect equalization of strains in centre posts under all conditions of loading and position, and the transmission of load to the drum at the four points of intersection with cross-girders precludes any ambiguity of strains and permits unusual compactness and simplicity of turning gear. The draw is swung by a steam-engine geared directly to shaft E (see Fig. 3), which, through the idler I, engages shaft C in the required horizontal position, and through the bevel gear N drives the main shaft A, made in two sections, whose pinions at each end engage the bevelled wheels H H. H is keyed to a sleeve, loose on shaft G, but engaging at will a clutch sleeve, S, revolving with G. When the clutch engages, as shown in figure, G, by its pinion J, drives L, whose vertical shaft carries the driving pinion P, that works on the stationary curved rack R.

If for any reason the steam-power fails it is quickly disconnected by dropping handle *a* of the sleeve-lever, which releases clutch S.

If hand-power be required only temporarily a capstan-head can be placed on shaft G. This will require the strength of several men, and if hand-power is needed for any length of time the auxiliary gearing L', with capstan-head Q, is conveniently swung into position, and when secured in place provides a train suitably geared for operation by two men.

When closed the draw is secured by spring-latch X and to swing the attendant must just release it by partly turning shaft Z, whose pinion operates racks O O, each of which pulls latch-rod M, compresses spring Y, and withdraws bolt X. The turning gear may now commence to operate, and the attendant completes the stroke of the lever, turning Z. M, being pulled to its limit, draws the latch-tail U through the aperture in the end floor-beam until it is sufficiently depressed by guard V to lift the catch out of draw-loop W, and the spring Y being released throws the bolt out ready to lock when the bridge is swung to its seat.

No lifting-gear is provided or required, as the the ends rest on beveled shoe-plates that are forced by the turning mechanism to ride up on to their roller-seats and insure the intended bearing contact when the bridge is unloaded; the lower lateral system is proportioned to receive the impact and flexure from this strain.

The trusses are assumed to carry all pressure to centre pier, except when strained by live loads.

Each panel of top chord is lengthened $\frac{1}{4}$ -inch for camber. All truss members are wrought-iron, except the annealed steel eye-bars and steel chord-pins fitting holes up to 5 inches diameter within $\frac{1}{8}$ -inch, and holes above 5 inches within $\frac{1}{4}$ inch. The mill and shopwork, quality of material, etc., was according to standard bridge specifications of the Chicago, Milwaukee & St. Paul Railroad.

The structure was proportioned for a live load, on chords, of 2,600 pounds per foot of track over all, or 3,000 pounds per foot on one arm, for ties and posts, and two Mogul engines, followed by 3,000 pounds per foot of track; and the floor system for two Mogul engines, + 25 per cent. for floor beams and + 30 per cent for stringers for impact.

The shipping weight of trusses was 416,143 pounds; of castings and mechanism, 56,438 pounds; extras, 60,722 pounds; total metal weight of structure, 533,303 pounds.

TESTS OF THE WESTINGHOUSE AIR-BRAKE.

WE take great pleasure in noticing the tests of this apparatus made on the West Shore road at Ridgefield, N. J., on Monday last, for the reason that we believe it marks another long step towards absolute safety in handling railroad trains.

Mr. Westinghouse has been long working on the problem, and now expresses himself as satisfied that he has obtained a form of apparatus that is simple, easily managed, and durable.

The special train arranged for these tests consists of fifty freight cars, each of 60,000 pounds capacity and weighing about fifteen tons.

The portion of track selected had a down grade of 53 feet to the mile, and the tests and results were as follows, all tests being made on the down grade:

First, an emergency stop from a speed of 23 miles an hour. The time occupied, $12\frac{1}{4}$ seconds, and space traveled, 203 feet.

Second, the same from a speed of 41 miles an hour, accomplished in $19\frac{3}{4}$ seconds, and 674 $\frac{1}{2}$ feet distance.

Third, a test of quickness of application. In this test the whistle was heard announcing the application of the brake, and the brake was in full action at the end of the train at practically the same instant. In other words, the impulse applying the brakes and the sound-wave through the air traveled at the same speed. Mr. Westinghouse says the speed has been determined as about 1,000 feet per second, or $1\frac{1}{2}$ seconds through the fifty-car train. They had succeeded in reducing this one-eighth of a second, but the reduction did not compensate for difficulties in other directions. The air-pipes are increased one quarter inch in diameter, or to an inch and a quarter in the new apparatus.

The fourth test was an emergency stop from 41 miles per hour, to show passengers on board the effect of quick stopping. This was accomplished in 20 seconds, and 672 $\frac{1}{2}$ feet.

The fifth test was to show the time required to release the brakes after stopping and getting the train in motion again. This was $4\frac{1}{4}$ seconds.

The sixth test was by hand brakes alone with five brakemen. This required 84 seconds, and a travel of 2,137 feet. Of course had the locomotive brake been applied also the distance would have been greatly reduced.

Seventh test.—In this the train was broken in two when at a speed of 25 miles per hour, and both portions stopped with an intervening distance of 43 feet.

Eighth test.—An emergency stop from 22 miles, with 20 cars to represent an ordinary passenger train, all available means of stopping being used. This was accomplished in six seconds, with a travel of 91 feet.

The ninth test on the programme was omitted on account of the lateness of the hour.

The tenth test consisted of the 20-car train on one track, and a train of ten heavy passenger cars (about 18 tons each) on the adjoining track, the latter fitted with the ordinary Westinghouse brake.

The speed acquired at the point where the brakes were applied was 45 miles. The 20-car train stopped in $13\frac{1}{2}$ seconds after running 495 feet. The passenger train ran 1,204 feet before stopping.

Such exhibitions cannot help resulting in great good, since they bring the brake so prominently before all who are interested in such matters in the locality where they are made; and we were glad to know that railroad men, professors, students, and capitalists were fully represented among the observers.

LONDON CORRESPONDENCE.

Austrian Bridge Construction Regulations—International Exhibition of Fire-Extinguishing Apparatus at Paris—Anglo-American Brush Electric-Light Company in London.

RAILWAY engineers will be interested to note the new regulations issued by the Ministry of Commerce at Vienna with regard to the building of railway bridges in the future. Briefly stated, these are, that constructive engineers of bridges with a span of sixty-six feet or more will have to file plans and full particulars respecting foundations, piers, girders, weight, rolling load, strain, and limit of deformation. Tabular matter has been prepared by the ministry averaging the span and weight of the bridge with regard to loads.

AN "International" Exhibition is announced to be held from the 25th inst. in the Municipal Pavilion of the Champs Elysées, Paris, which, in the present state of public feeling, will doubtless prove a success. The object of the exhibition is to exhibit fire extinguishing and preventing apparatus, and it is announced that there will be theatrical performances with sham fires introduced.

THE Anglo-American Brush Electric-Light Corporation are again about to try the experiment of introducing the electric light into the city of London. They have obtained the consent of the City Corporation to lay a main over Blackfriars' Bridge into the city, the City Corporation stipulating that the company shall supply householders on the route at the same price as that charged for the city. As a new electric-lighting bill, doing away with the stringent "old iron clause" in the old one, will doubtless be passed in the course of the next year or two, the A. A. B. Co. evidently anticipate more favorable opportunities to do business.

THE GIRARD COLLEGE ROOF.

(Correspondence.)

PHILADELPHIA, November 22.

CONSIDERABLE excitement was caused in the building circles of Philadelphia by the announcement that the marble roof of the Girard College building was leaking and was about to be covered with tin. Investigation proves the report to be true. The architect in charge of the works of the Girard Trust, Mr. James H. Windrim, says that by the action of the water and the fumes of bituminous coal the marble roof of this great building has become disintegrated and soft, and in consequence of this the rain has been running through. At a meeting of the Girard Trust the project of replacing the roof with a marble one was discussed, but as it would cost some \$150,000 and a tin one but about \$10,000, it was determined to use the latter. The marble-work now forming the roof will not be removed, but in the spring a roofing of sheet-tin will be put over the boarding now in place.

EIGHTY-FIFTH ANNUAL REPORT OF THE PHILADELPHIA WATER DEPARTMENT.

THIS complete and exhaustive report begins with that of the Chief Engineer, Mr. John L. Ogden, the remainder of the volume being made up of appendices by the Registrar, Mr. A. N. Heithler; by the Chief Clerk, Mr. J. T. Hickman; by the General Superintendent, Mr. F. L. Hand; by Assistant Engineer, Mr. Allen J. Fuller; by Mr. W. F. Courtney, Shop Superintendent; by Mr. John E. Codman, Chief Draughtsman; by Assistant Engineer, Mr. Amasa Ely, on Hydrographic Work; by Mr. Rudolph Hering, Engineer in charge of Surveys for new supply; and addresses by Drs. Charles W. Dulles and J. Cheston Morris on Water-Supply.

The total receipts for the year ending February 1 were nearly \$2,000,000, being an increase of $5\frac{1}{2}$ per cent. on the previous year.

Deducting special appropriation of about \$565,000 for extensions, the excess over expenses was \$1,368,000.

The least amount of water pumped per day was 49,187,598 gallons in February; the greatest 102,202,857 in July, and the average 78,433,289. The increase in amount pumped for this over the preceding year was about 14 per cent.

Of the total supply about 90 $\frac{1}{2}$ per cent. is from the Schuylkill, about 7 per cent. from the Delaware, and the remainder from springs at Chestnut Hill. That from the Delaware at Otis Street is through a conduit reaching 200 feet beyond the wharf and 34 feet below low water.

The population has increased from 795,000 in 1877 to 975,000 in 1886, or nearly 23 per cent., while the consumption per capita has increased from 61 gallons to 80 gallons, or over 31 per cent.

Of the total pumpage, about 25 per cent. is by water-power and the remainder by steam. The cost, including repairs, was \$2.09 per million gallons raised 100 feet by water, and \$4.48 by steam, or \$4.13 for the total pumped.

The actual cost, including running expenses of stations, was \$6.66 per million gallons raised into the reservoirs, or, including the total expense of the department, \$14.59. If to this interest at six per cent. on \$15,000,000 (value of plant) be added, the cost per million gallons would be \$46.

The revenue of the department for the year was \$61.86 per million gallons, showing that it is advisable to reduce the rates, especially to manufacturers.

The 36-inch submerged main across the Schuylkill, laid many years ago, having Ward's patent joints, needs renewing.

The East Park Reservoir, on which work ceased twelve years ago, it is recommended should be completed. This will add 701 millions to the storage capacity. That this is necessary is shown by the fact that the storage available for no part of the city exceeds eight days, and from this it varies for other parts to as low as two and a half days. About 185,000 persons are supplied by direct pumpage.

The experiment of purifying the water by aeration (forcing in air under pressure) was tried. Twenty per cent. of air by volume caused the almost complete disappearance of free ammonia, and the destruction of one-half the albuminoid ammonia. The difficulty was a great increase in leaky joints, the leaks ceasing as soon as the air-compressors were stopped.

About 137,000 feet of extensions were made to the mains, which, with pipes relaid, made a larger amount than in any previous year. The total pipes in use now measure 853 miles.

A new compound Gaskill pumping-engine has been erected by the Holly Manufacturing Company, capable of supplying 20,000,000 gallons per day, with a guaranteed duty of 110,000,000, and at a cost of \$69,000. The seven boilers, costing \$26,965, by J. P. Morris & Co., are rated at 560 nominal horse-power.

Detailed tests of two of the boilers are given. They evaporated eleven pounds of water from and at 212° Fah. per pound of combustible, furnishing very dry steam, and developed forty-four horse-power more than they were rated at. Drawings are given of the boilers and settings in use.

The report shows that the minimum flow of the Schuylkill is 245,000,000 gallons per day—an amount sufficient to supply the city thirty years hence. Of this flow nearly two-thirds is now used in furnishing power for pumping. By inexpensive storage-reservoirs on the mountain streams this flow could be increased.

Mr. Ogden holds that the water of the Schuylkill is wholesome, but that it can and will be improved both in appearance and quality. The suggestion of filter-beds is made. The completion of the intercepting-sewer will aid in improving its quality.

Mr. Ogden thinks it well to select streams as a source of increase after the Schuylkill is fully utilized, so that their collecting areas may be purchased and turned into parks or forests and kept free from contamination.

Complaint is made of the increasing difficulty of laying large mains on account of the sewers, drains, gas-pipes, electric-conduits, etc. The cost in one case was increased 19 per cent. in consequence.

Mr. Ely describes and illustrates an automatic stream-gauge, and also the method pursued for gauging during freshets.

Mr. Hering's report is very full and complete, entering into a discussion of questions of topography, precipitation, stream-flow, storage-reservoirs, their capacity and cost per million gallons stored, and quality of water. Very full tables are given, specimens of maps and engravings of instruments used; also, curves of discharge, etc., etc.

It is seldom that an engineer has an opportunity of giving so much and such varied information in a single report.

THE ENGINEERS' CLUB OF ST. LOUIS.

The club met at Washington University, November 16, 1887, President Potter in the chair; W. H. Bryan, Secretary; thirty members and four visitors present. The following persons were elected to membership: A. C. Glasgow, R. F. Grady, J. A. Laird, Frank Nicholson, P. W. Schaumleffel, and J. P. Thul. After a discussion on a communication from the Board of Managers of the Association of Engineering Societies the following was adopted:

Resolved, That in the opinion of the Engineers' Club of St. Louis an attempt at an organic union is not desirable. We, therefore, decline to favor the recommendation of the Board of Managers.

The following committee on nominations of officers for the coming year was then elected: J. A. Seddon, chairman; R. E. McMath, S. B. Russell, E. A. Engler, J. A. Ockerson. Professor Johnson then read a paper on "Testing the Strength of Engineering Materials," in the course of which he said that to load a member slightly beyond its elastic limit did not necessarily injure it; in fact, to thus "take the stretch out of it" might even benefit it for some purposes. Mr. Nipher exhibited a cast-iron cup which had been attached to the bottom of a piece of wrought-iron pipe filled with water, and broken by firing a rifle ball from above into the water.

WIDENING THE NIAGARA FALLS AND CLIFTON SUSPENSION BRIDGE.

WE take the following from a communication received from Mr. M. Harrington, Superintendent of the Bridge:

"The first cable for the structure was carried over in the spring of 1865, on the ice bridge, and the structure completed in the winter of 1868. It was publicly opened on January 2.

"Many changes have been made since in the appearance of the bridge. The original towers were of heavy framed timbers, exposed to view, but afterwards covered with corrugated iron. In 1884 these gave way to the present handsome iron towers. The present Superintendent, shortly after his appointment, a few years ago, made a thorough inspection of the anchor pits, anchorages, etc., the first that had been made since the bridge was built, and found everything as perfect as when the bridge was first put in position.

"Plans have recently been adopted for increasing the width of the bridge, and in accomplishing the work it will be necessary to practically rebuild the entire structure, except the towers. This will not, however, interfere with travel across the structure.

"The present anchor-plates on the New York side are 18 feet below the surface of the ground; the new plates will be 50 feet below the surface, 26 of which will be in solid rock. Each anchorage shaft plan will be 7x3 feet and 26 feet in depth, at which point the anchor plate will be set. It is a casting 5 feet 6 inches square by 32 inches in depth, chambered out to secure the anchor-bars, which are 14 in number, $\frac{3}{8}$ x6 inches. From this point the number of bars are gradually increased to the point where connections are made to the cables, and will terminate in 28 bars giving a sectional area of 125 square inches, equal to a bar about 11 inches square of solid iron. The cables are composed of galvanized steel wire-ropes $2\frac{1}{4}$ inches in diameter, seven of these ropes forming one cable, each rope having a separate fastening to the before-mentioned anchor-bars. There will be one pair of cables on each side of the bridge seven inches in diameter, or four cables in all. On the Canadian side the anchorages will be similar, except that the anchor-plates will be set 36 feet below the surface of the earth, owing to the fact that the rock comes to the surface of the earth at that point.

"The present cables are amply competent to carry the additional load of the widened bridge. They are of first-class charcoal iron, but as the moduli of elasticity of steel and iron are not the same it is impossible to equitably divide the load between the two sets of cables of different materials necessitating the abandoning of the present cables for steel ones. The road-bed when completed will have a clear width of sixteen feet, the present being only ten feet. The present suspenders by which the bridge proper is held to the cables are of $\frac{3}{8}$ wire rope, for which $\frac{3}{4}$ wire rope will be substituted. The present truss system of six feet in depth will be changed to iron of twelve feet in depth, and all transverse beams will be of plate and angle iron, the flooring being secured to rolled I-beams. The system of overhead stays will be abandoned, owing to the change made in the depth of the truss. It is the intention to abandon the river guys, substituting therefor a lateral wind cable system that will far more effectually perform the service imposed upon the river guys, and thus do away with the damage incident to them by floating ice and falling rocks, which has been an expense of no small amount.

"The work will be done under the personal supervision of G. W. McNulty, of the firm of Buck & McNulty, Civil Engineers, of New York. The iron will be furnished by the Rochester Bridge Works, and the wire ropes will be supplied by the John A. Roebling's Sons Co., of Trenton. The work of excavation will be done by Messrs. Phillips & Young, of Niagara Falls, who began work the last of August. The work of stringing the cables has been commenced. The contracts require the completion of the work by the 15th of April next."

WESTERN ASSOCIATION OF ARCHITECTS.

AMONG those present at the Annual Convention of the Western Association of Architects at Cincinnati last week were the following gentlemen:

D. Adler, Chicago; Henry Lord Gay, editor *Building Budget*, Chicago; James F. Alexander, Lafayette, Ind.; James E. Wolfe, editor *California Architect and Building News*, San Francisco; Charles E. Hellmers, St. Louis; Charles Crapsey, Cincinnati; E. A. Wells, Wheeling, W. Va.; George W. Cramer, Akron, O.; J. M. Freese, Columbus, O.; E. Anderson, Cincinnati; H. M. Parker, Coldwater, Mich.; J. A. Treat, Chicago; Louis Sullivan, Chicago; H. A. Linthwaite, Columbus; J. W. Taylor, Chicago; Guy Tilden, Canton, O.; George W. Thompson, Nashville, Tenn.; John Sutcliffe, Birmingham, Ala.; John M. Root, Chicago; Clarence O. Arey, Cleveland; W. W. Carlin, Buffalo, N. Y.; Paul C. Lathrop, Chicago; J. W. Yost, Columbus, O.; A. E. Siter, Cincinnati; W. S. Matthews, Kansas City; R. C. Berlin, Chicago; A. Y. C. Clas, Milwaukee; L. J. Schaub, Chicago; Howland Russell, Milwaukee, Wis.; F. S. Allen, Joliet, Ill.; E. O. Elzner, Cincinnati; Normand S. Patton, Chicago; Sidney Smith, Omaha, Neb.; Frederick Bauman, Chicago; Oscar Cobb, Chicago; J. J. Flanders, Chicago; F. G. Cowen, Minneapolis, Minn.; R. A. McLean, Chicago; H. C. Lindsay, Zanesville, O.; Bernard Vonnegut, Indianapolis; Cyrus K. Porter, Charles K. Percival, Jesse R. Porter, Buffalo, N. Y.; John K. Allen, the *Sanitary News*, Chicago; William K. Aiken, Cincinnati; S. H. Maetzel, Columbus; George L. Fisher, Omaha, Neb.; Albert B. Baumann, J. F. Baumann, Knoxville, Tenn.; Walter R. Forbush, Cincinnati; George J. Fickes, Steubenville, O.; Gustav W. Drach, George W. Rapp, Cincinnati; William Nier, Kansas City; T. Fitzhugh, Cincinnati; Emil G. Rueckert, Cincinnati; Max Reutti, Hamilton, O.; Charles E. Baldwin, Minneapolis; Frank J. Otter, Dayton, O.; C. C. Burke, Memphis; W. R. Brown, Cincinnati; Curtin, Louisville, Ky.; James W. McLaughlin, Cincinnati.

FRANKLIN, MASS., WAS REFERRED TO.

CINCINNATI, November 23, 1887.

SIR: In your issue of 19th inst. under head of "Lessons From Recent Water-Works Disasters," among other places mentioned, you speak of the fall of the Franklin Water-Tower.

As there are several Franklins in the United States, and as I happen at the present time to be engaged as the engineer constructing the Franklin, O., Water-Works, where the service is direct, with no water-tower or stand-pipe, will you kindly state that the Franklin you mean is not my Franklin, to avoid a possible false impression taking root among your readers in this part of the country? Your remarks upon this topic receive my hearty commendation. Very respectfully yours,

JOHN W. HILL,
Consulting Engineer, Franklin, O., W. W.

REGISTRATION OF VITAL STATISTICS IN NEW YORK STATE.

FROM the report of Dr. Balch, the Secretary of the State Board of Health of New York, for the first half of 1887, we learn that the registration of vital statistics in the State is becoming more complete and accurate. Forty-eight thousand deaths were reported in the State during the half year, being over 3,000 more than the number reported in 1886, and 10,000 more than in 1885. The health of the State has been remarkably good, and this increase in the number of deaths reported is due entirely to the fact that the returns are more complete. The true mortality-rate of the State for the first six months of this year was probably about 18 per 1,000. Diphtheria caused a larger number of deaths than any other zymotic disease, nearly one-fourth of the preventable diseases being from this cause. About 62.5 per 1,000 of the total was from diphtheria. About one-eighth of the zymotic mortality was from measles. Scarlet fever was epidemic in smaller localities, about 100 deaths a month having pretty constantly occurred thus far this year. Cerebro-spinal fever has occurred very uniformly month after month. There were about 300 deaths from January to July. Troy reports a large proportion of the deaths, and they occur, not spasmodically, but constantly. The central and western counties are quite free from it. Only one case of typhus fever, and that from Brooklyn, is reported. From small-pox 127 deaths, twice as many as in 1885 and 1886, were reported. Most of these occurred in New York and Brooklyn, three deaths occurring in Albany, the origin of which was traced to Brooklyn. There were 6,800 deaths from acute respiratory diseases, and from consumption 6,827, or about 130 per 1,000. In 1885 there were 140 deaths and in 1886 138 per 1,000.

WE quote from a recent number of the *Electrician* the following French specification filed by La Société pour la Transport de la Force par l'Electricité, for a method of lighting railroad cars by electricity. The proposal is to place a small windmill on the roof of each car, and so provide power for the dynamos, secondary batteries and lamps. The *Electrician*, commenting on the above, says, that while it hopes for the best, yet they are prepared—fully prepared—for the worst.

PERSONAL.

COLONEL C. B. PENROSE, U. S. A., left St. Paul last week for Fort Leavenworth, Kan., his new station.

CAPTAIN L. E. CAMPBELL, U. S. A., left Fort Leavenworth a few days ago for Denver, Col., where he will hereafter be located.

PROF. S. P. LANGLEY, has been elected by the Regents of the Smithsonian Institution, to the position left vacant by the death of Prof. S. F. Baird.

DR. JOHN S. BILLINGS, Surgeon U. S. A., of Washington, D. C., has been elected President of the Congress of American Physicians and Surgeons which is to meet in Washington next September.

GOVERNOR HILL has appointed Mrs. Charlotte S. Williams, of Buffalo, and Mrs. Caroline B. Stoddard, of Rochester, to fill the vacancies in the Board of Managers for the State Insane Asylum at Buffalo, N. Y.

ENGINEER THOMAS J. WHITMAN, of St. Louis, has entered upon his duties of investigation in connection with the sewerage problem in Milwaukee. Draughtsmen and clerks necessary to do the detail work in connection with the investigation will be employed.

THEODORE R. VARICK, M. D., President of the Hudson County, N. J., Board of Health, Director of the State Asylum for Insane at Morris Plains, and a member of New York Academy of Medicine, died at Jersey City, November 23, aged sixty-one.

CONTRACTING NEWS DEPARTMENT.

A WEEKLY RECORD

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

ARCHITECTURAL COMPETITIONS.

COURT-HOUSE.—Plans for Court-House wanted, until December 5, by James P. Coffin, Commissioner of Public Buildings, Powhatan, Lawrence County, Ark.

FORT WAYNE, IND.—Plans and specifications for a new city hall to cost about \$60,000. Building to be 50x140 feet and to contain accommodations for all the city officers, a council chamber, also a police prison and office, with accommodations for four horses and two patrol wagons. Until December 6, address Charles F. Muhler, of the Special Building Committee of the Common Council.



For works for which proposals are requested see also the "Proposal Column," pages 729-732-733-736-751.

Persons who make any use of the information they find in these columns we trust will not omit to mention THE ENGINEERING & BUILDING RECORD as the source.

Our readers will oblige us by notes, clippings, or any information which will put us in the way of obtaining early and reliable news for our "Contracting Intelligence." Information of importance sent to us exclusively, and not elsewhere published, will be liberally paid for.

WATER. SEWERAGE, ETC.

TUSCALOOSA, ALA.—This city has closed a contract with Jeter & Boardman, of Macon, Ga., for a complete system of water-works.

PONTIAC, MICH.—Proposals are wanted for water-works here. Address, until December 21, F. B. Galbraith, Mayor.

CENTRAL CITY, KY.—Water-works are contemplated and will probably be built soon. The Central Coal and Iron Co. can give particulars.

MARBLE FALLS, TEX.—J. J. M. Smith, of this place, wants to correspond with manufacturers of water-works supplies.

WINCHENDON, MASS.—Our correspondent writes: "A committee has been chosen to investigate the subject of water-works and make surveys and report at the annual meeting in March, 1888."

MILWAUKEE, WIS.—Messrs. Gray Brothers write: "We have contract for boring a well at West De Pere, Wis., and until that is finished they will do nothing in regard to mains or hydrants. Their intention is to supply the town with water."

PENSACOLA, FLA.—Our correspondent writes: "This municipality has adopted the Waring system, which will cost about \$90,000 when completed. Expect to commence work in December."

WESTERVILLE, O.—Concerning a report that water-works were to be built here, our correspondent writes as follows: "There has been no steps taken for water-works officially. There has been some talk by citizens, but nothing more."

JACKSONVILLE, ILL.—Our correspondent writes: "The following was passed by the City Council Tuesday evening, November 15: 'Resolved, That the Board of Water Commissioners be instructed to advertise for proposals to furnish the city with one or more million gallons of water every twenty-four hours. All propositions to be submitted to the council for their approval or rejection.'"

KINSLEY, KAN.—The contract for the water-works has been awarded to D. Mitchell & Co., of Dodge City, Kan., who will have the system in operation during January. There will be pumping-engines with a daily capacity of 750,000 gallons, four miles of mains and a stand-pipe.

LAKE LINDEN, MICH.—Our correspondent writes: "We have just completed a system of water-works, 85 pounds gravity pressure. The system cost about \$40,000, and for fire protection is equal to the best, the supply being all that could be desired."

RAHWAY, N. J.—The contract between the Pennsylvania Railroad Co. and the Water Board, which the company recently refused to renew because of increase of rates, has been renewed at old rates, \$4,000 per annum, with privilege of either party upon thirty days' notice ending the same.

COLUMBUS, NEB.—The contract for an additional steam-pump and boiler has been awarded to Charles Schroeder, the contractor for the works, at \$2,150.

COSHOCOTON, O.—The contract for the water-works has been awarded to the American Water Works & Guarantee Co., of Pittsburgh, Pa. The company will have the system in operation by January.

KENDALLVILLE, IND.—Contracts have been awarded to the Knowles Steam Pump Works, of New York City, for pumps; to R. D. Wood & Co., of Philadelphia, Pa., for pipe and hydrants; and to James Flower & Bro., Detroit, Mich., for valves.

DOVER, N. H.—The citizens will settle the question of building water-works by a vote at an early day. The cost of the project now contemplated is \$280,000.

NORFOLK, VA.—An improved system of water-works will probably be established here shortly, as the present system is deemed insufficient. At a recent meeting of the Common Council, Mr. John R. Todd, registrar of the Water-Department, submitted three propositions for furnishing the city with water. The matter was referred to the Water Committee for immediate investigation. Mr. Todd can give full information.

PENSACOLA, FLA.—The Board of Health have appropriated \$15,000 to construct the sewerage system. The Mayor can give information.

OCALA, FLA.—Water-works are to be erected here at once.

JOLIET, ILL.—This city wants proposals for water-works, until January 1. Address John D. Paige, Mayor.

SHERMAN, TEX.—This city has made a contract with E. Sutphin for a daily supply of 1,000,000 gallons of water for \$33,000.

COLUMBUS, O.—The Sanitary Committee has been instructed to enter into correspondence with sanitary engineers with a view of securing a suitable opinion as soon as possible concerning the defects in their sewerage system.

SEABRIGHT, N. J.—A stock company will probably be formed here to supply residents with artesian water.

SANDUSKY, OHIO.—The city will vote on a proposition to issue \$32,000 in bonds for a new pumping engine for the water-works.

KEY WEST, FLA.—Our correspondent says: "We are in communication with George E. Waring, Jr., Esq., and will probably secure his services to give us a plan and estimate for a system of sanitary engineering."

GREENVILLE, TEX.—Our correspondent says: "City had contract with M. P. Kelly and J. R. Williams (former of Corsicana, Tex., latter of St. Louis) to put in water-works, same to be completed by November 1, 1887. They purchased ground for plant, but did nothing more, and hence forfeited their franchise and bond for construction. Suit is ordered to be instituted on bond. No bids are being considered at present, though city is very anxious for a plant to be put in. Compress with 3,000 bales cotton burned three days ago here. No bids are now before the Council."

PHILADELPHIA, PA.—The first of the new subsidizing reservoirs, known as the East Park Reservoir, was put in use November 21. The Mayor will ask for appropriations next year to complete two more sections, which, when finished, will have a total capacity of 750,000,000 gallons.

AUSTIN, ILL.—Our correspondent writes: "The Cicero Water, Gas and Electric Light Company has bought the Scoville plant at Oak Park and now proposes to supply a territory contiguous to Chicago (on the west) with a No. 1 artesian water; said territory is 3x5 miles."

MANITOWOC, WIS.—Our correspondent says: "The Board of Aldermen of this city has granted a water-works franchise to Moffett, Hodgkins & Clarke, of Watertown, N. Y., for 20 years. System contains 12.3 miles of pipe, 6-inch to 16-inch, and 132 hydrants. Annual rental, \$6,500; two pumps of 1,500,000 gallons each. Water is to be taken from filtering galleries on shore of Lake Michigan, which experiments have proved most clear and wholesome, and which will undoubtedly result in a large number of water-takers. Work will commence early in the spring."

TOPEKA, KAN.—The Topeka Land and Water Power Company submitted a proposition to the Council to vote \$150,000 in 5 per cent. 20 years' bonds to aid in the construction of a dam, and rent power. The Council fixed December 6, 1887, as the day of election to submit the proposition to the people.

GENEVA, N. Y.—Our correspondent writes: "The Worthington pump and boiler for same have been delivered at this station on the lake shore. The building is nearly completed, and the contractor is building a coffer-dam 600 feet into the lake for the supply-pipe; the force main is all completed."

SUPERIOR, NEB.—Our correspondent says: "The city of Superior has only arranged to receive bids or estimates for water-works. There is to be a franchise granted in case the plans and specifications are satisfactory."

ST. SAUVEUR, CAN., P. Q.—Our correspondent says: "Our water-works is yet in contemplation; no decisions have been determined; so far we have only asked for plans and best means of construction."

THOMASVILLE, GA.—Bids for the following water-works supplies will be received by the undersigned up to November 30: Water-pipe, 2,500 feet each of 8-inch, 6-inch, and 4-inch, 100 feet of 3-inch; gates, two 8-inch, five 6-inch, four 4-inch, two 3-inch; 20 double-nozzle fire-hydrants, 13 stop-gate extension boxes, etc. A. F. Prevatt, Thomasville, Ga.

NEW YORK CITY.—The project for taking water from the mountain brooks in the town of Warwick and the various ravines and watersheds of the Ramapo Mountains, for use in supplying this city and Brooklyn, has been pushed forward steadily during the past season. Maps for the various reservoirs, pipe-lines, rights of ways, etc., which will be needed to carry it out, have been filed in the Clerks' Offices of Orange, Rockland, and other counties, the system would pass through. It is believed that the scheme will in a few months take a definite shape and the coming season may see active operations on foot by a strong corporation. The head of all the system as proposed will be in the valley of the Long House Creek.

MONTREAL, CAN.—The Lawrence Machine Company, of Lawrence, Mass., have been awarded a contract for a pumping-plant in this city. The plant consists of four centrifugal pumps, each of which is capable of conveying 18,000 gallons of water per minute, and four smaller pumps that are each able to discharge 7,000 gallons per minute. The large pumps can thus take care of 72,000 per minute, 4,320,000 per hour, 103,680,000, or 366,000 tons of water per day, and the small pumps would remove 28,000 per minute, or 1,680,000 per hour. The pumps are intended to drive the sewage of the city over the walls and dikes which are now being erected in the lower part of the city to protect it from big freshets.

ULYSSES, KAN.—Our correspondent writes: "Water-works company just incorporated. Will not commence work until next summer at least."

HAYWARD, WIS.—Our correspondent writes: "We are putting in the water-works now and are soon to be completed."

ST. LOUIS, MO.—Our correspondent writes: "Negotiations in progress for purchasing site for pumping works and intake from river at Chain of Rocks. Bill to provide for employment of the necessary engineers, inspectors, etc., introduced in House of Delegates, November 15."

PLYMOUTH, O.—Our correspondent writes: "There has nothing definite been done in regard to any water-works in our place."

TREMSEH, MICH.—In reference to a report that an improved water-works system was to be built here, our correspondent writes: "The township is taking no steps in that direction. The village has small water-works, but are not talking of anything more. Have just been erecting a tank at a cost of \$2,500."

ALBERT LEA, MINN.—Our correspondent writes: "The matter of water-works has just been brought before the Council for consideration and the system is to be the direct-pressure—'Holly.' The formation of a company, securing a franchise, establishing the number of miles of mains and sub-mains, and the agreement of price the city is to pay for hydrants is yet to be decided. No immediate action is deemed advisable by Council, but the inclination is to accept the plan of paying a rental to a company rather than issue bonds. An artesian well, 217 feet deep, has been tested and analyzed, proving water first quality for household purposes—not quite soft—and of abundant supply."

PASSAIC, N. J.—It is probable that this city will soon make a movement towards a better sewerage system. The question is being agitated by officials and citizens.

CARLYLE, ILL.—The water-works erected for this city by the Water, Light, and Power Company, of St. Louis, still remains unaccepted by the City Council. The plant is said to be incomplete and not in accordance with the specifications of the contract. At the recent test of the works with stand-pipe and pump pressure at four points the water failed to reach the required height at one point, on account of 4-inch mains being used in that part of the city. With 4-inch mains water is forced 115 feet high. The company may be compelled to replace the 6-inch mains with 6-inch pipes before the works will be accepted by the Council.

WINDOM, KAN.—Our correspondent writes: "Our bonds of eight thousand dollars, for a system of water-works, carried by a large majority. We have abundance of water about two miles north of town, but the method of getting it here has not been decided upon. The board is ready to entertain propositions for this purpose."

CHICAGO, ILL.—The contract was executed November 19, between this city and Andrew Onderdonk, of New York, for the construction of the new water-works tunnel under the lake. The work will cost \$748,000, and the contractor gave a bond for \$500,000. The new tunnel is to be eight feet in diameter, and will extend from the south side lake front a distance of four miles into the lake.

COLUMBUS, O.—At a recent meeting of the Water-Works Trustees, a resolution was adopted to do away with the bids for a 15,000,000-gallon pumping-engine, which were received November 1, 1887, as they did not comply with the requirements of the advertisement for the same, and the superintendent was instructed to prepare specifications and readvertise for new bids to be submitted to the board at an early date.

VALLEY FALLS, KAN.—The contract for the water-works has been awarded to the U. S. Wind Engine & Pump Co., of Batavia, Ill., at \$14,778.

ALTOONA, PA.—Our correspondent writes: "The present reservoir embankment is being raised so as to impound 40,000,000 gallons more. Surveys have been made to several sources and estimates of cost which matter is now before the city council and will be referred to the Water Commissioners for recommendations."

GAYLORD, MICH.—Our correspondent writes: "This place voted November 15, to put in regular system of water-works."

PRINCETON, ILL.—Our correspondent writes: "The City Council has appropriated \$5,000 for an artesian well. The contract has just been awarded to J. P. Miller, of Chicago. Work will probably be commenced in ten days."

SOUTH FRAMINGHAM, MASS.—The question of a sewerage system is being agitated here. Developments are expected soon.

LANSINGBURG, N. Y.—1,000 feet of water-pipe will be laid here. Proposals will soon be wanted.

DUBUQUE, IOWA.—Our correspondent writes: "Franchises at Baton Rouge, La., was extended to Smedley & Wood, for 30 years; city has privilege of buying in 20 years; works exempt from taxation 15 years. There will be 2 one-million compound duplex pumping engines (Smedley manufacture), steel stand pipe, 6 miles of pipe from 12 to 4-inch; standard weights, 75 fire hydrants. City to pay \$45,000 a year rental for 75 hydrants."

MARIANNA, ARK.—Our correspondent writes: "The city contracted with the Fairbank Co. for a wind-mill and a tank of about 1,000 barrels capacity, but the company afterward refused to comply with their contract. Hence, the matter stands as before—open for propositions."

BRIDGES.

TOLEDO, O.—Our correspondent writes: "All surveys and location have been made by the Wheeling and Harrisburg Railway Company, and plans have been approved by the Secretary of War for a railway bridge over the Ohio River between Wheeling, W. Va., and Martin's Ferry, Ohio, at the head of Wheeling Island. It is expected that construction will begin in the early spring. The bridge will be 2,100 feet long, 90 feet above low water, with two deck spans 125' each, one through-span of 125', one of 130', one of 535' and four of 265' each."

SIoux CITY, IOWA.—The contract for the Iowa approach to the railway bridge for the Chicago & Northwestern Railroad across the Missouri River has been awarded to W. C. McNamara, of this city.

GOLIAH, TEXAS.—The following proposals for a bridge across the San Antonio River have been received at this city: Kansas City Bridge and Iron Company, Kansas City, Mo., \$11,500; Missouri Valley Bridge and Iron Works, Leavenworth, Kan., \$12,540; King Iron Bridge and Manufacturing Company, Cleveland, Ohio, \$12,500. The contract was awarded to the Kansas City company. The bridge will be a wrought-iron, double intersection high truss bridge, 140 feet span, 18 feet roadway, on cylinder piers of 3/8-inch iron 4 feet diameter, filled with concrete.

MARYLAND.—The contract for the construction of the substructure of the iron bridge across the Patapsco River, has been awarded to David Leonard: Masonry, \$13.50 per perch; piles, \$7.50 each; timber, \$30 per 1,000 feet, B. M.; bolts, 6 cents per pound. The bridge will be 200 feet span and will cost \$11,000.

CHARLESTON, W. VA.—The Charleston Bridge Co. has been chartered to build a bridge across the Kanawha River by R. M. Carr and S. M. Snyder, of Charleston, and others. The capital stock is \$50,000.

ERIE, PA.—Hon. W. L. Scott writes us that the announcement in regard to the proposed bridge across the Youghieny River is premature, although he expects to build a bridge there some time next summer.

CANTON, O.—John Hahn has been awarded contract for the construction of a bridge at this place.

BOSTON, MASS.—The Boston and New York Railroad is about to begin the construction of a new short-line road between New York and Boston. Bridge contractors should address at once D. C. Linsley, Managing Director, 146 Broadway, New York.

SAN JOSE, CAL.—Concerning bridge matters at this place, our correspondent writes: "A bridge across the Los Gatos Creek is under way. Contract awarded to San Francisco Bridge Co.; price, \$5,450.

Also, a bridge across the Guadalupe River is under way. Contract awarded to San Francisco Bridge Co.; price, \$5,450.

PORTLAND, ORE.—In answer to an inquiry concerning a reported scheme to erect a bridge over the Columbia River by the Columbia Bridge Company, our correspondent writes: "There is nothing being done at present. So far it is a project only."

DETROIT, MICH.—Our correspondent writes: "The city has contracted with the Milwaukee Bridge and Iron Works for constructing Belle Isle bridge for the sum of \$295,000, and the contractors are now getting out the timber preparatory to building the approaches thereto, also the stone for the substructure."

CALAIS, ME.—The contract for the construction of a bridge here has been awarded to the King Iron Bridge Company, of Cleveland, O.

BETHLEHEM, PA.—The Whisky Hill Bridge Co. will apply for a charter to erect a bridge over the Lehigh River in the County of Northampton.

ROCHESTER, N. Y.—In reply to an inquiry concerning bridge matters here, our correspondent writes: "The city is not engaged at present in the construction of any city bridges, although the subject of the construction of one or more is being agitated by the localities most interested."

COLUMBUS, NEB.—Our correspondent writes as follows: "Proposals are wanted for the construction of a bridge over Loup River, near this city. Until December 12, address John Stauffer, County Clerk, Columbus, Neb."

DETROIT, MICH.—In answer to an inquiry concerning the reported erection of new bridges over the railroad tracks at Fort Street, and at Lafayette Avenue, our correspondent writes as follows: "No steps have yet been taken towards the construction of the bridges mentioned."

NEW GLASGOW, N. S.—A report has recently been circulated that the people of this place contemplated building over the East River at Stellarton. Concerning such report our correspondent writes as follows: "No new bridges are contemplated in the place named, unless the Short Line Railway contemplates building one on their own account, which at present is highly improbable."

LINCOLN, NEB.—Concerning the erection of several bridges across the Platte River, our correspondent writes: "The bonds voted on November 8 failed to carry and no bridges will be built by the county very soon."

GAS AND ELECTRIC-LIGHTING.

LOWVILLE, N. Y.—The American Electric Light Co. will begin at once the erection of an electric-light plant here.

CHICAGO, ILL.—This city is agitating the question of placing additional electric lights along the river bank. Prof. Barrett has the project in hand.

DECATUR, ALA.—This place will shortly be lighted by gas.

BRISTOL, TENN.—H. H. Corson, representing the Thomson-Houston Electric-Light Co., of Boston, Mass., is negotiating for the erection of an electric-light plant for Bristol and Goodson, Va.

MANCHESTER, KY.—The Manchester Fuel, Power and Lighting Co. have asked for permit to build gas-works to cost from \$100,000 to \$150,000.

GLENDAL, O.—Alfred M. Allen will give details in relation to lighting the city for five years. Proposals are wanted.

ORANGE, MASS.—G. P. Warner has made a proposition to erect an electric-lighting plant here.

ANNISTON, ALA.—The Anniston Gas Co. has been organized, with a capital of \$25,000.

ARLINGTON, N. J.—The Thomson-Houston Electric-Light Co., 178 Devonshire Street, Boston, Mass., has been awarded the contract for the erection of an electric-light plant here.

ALTON, ILL.—The Gas Committee of the Council has reported in favor of the substitution of twenty electric street lights in place of others to be removed, and recommended that the contract be given to the electric-light company now holding the privilege. The report was adopted, and the committee empowered to make it.

BURTON, KAN.—This place has decided in favor of electric lights.

VANDALIA, ILL.—A 30-year franchise has been awarded to Messrs. George W. Brown and D. M. Clark to pipe the city and supply gas.

LEXINGTON, KY.—An ordinance directing the Mayor to contract with some one to bore for natural gas, with lease for ten years, has been passed by the Board of Aldermen.

HOOSICK FALLS, N. Y.—Messrs. Holmes, Lock & Hurd have been granted the franchise to erect and operate an electric-plant here. It will be completed by January 1.

KNOXVILLE, TENN.—The Knoxville Car-wheel Co. will erect an electric plant at their works.

LAREDO, TEX.—An electric-light plant is to be established here. A. L. McLane can give details.

ASHLAND, KY.—E. M. Roberts will establish an electric-light plant here.

NORRISTOWN, PA.—The Norristown Electric Light and Power Co. will make improvements.

OLEAN, N. Y.—The Olean Electric Light and Power Co. has been incorporated. Capital stock, \$25,000. W. M. Irish, G. V. Forman, and others, incorporators.

GOVERNUR, N. Y.—The American Illuminating and Power Co. has been incorporated. Capital stock, \$20,000. J. E. McAlaster, V. P. Abbott, E. D. Barry, and others, incorporators.

MILWAUKEE, WIS.—The Common Council has adopted resolutions authorizing a contract with the Badger Illuminating Company to erect and maintain electric lights at the intersection of certain streets. There are to be 30 lamps of 2,000 candle-power each. The contract is to extend from December 15, 1887, to December 5, 1890. The cost at present is to be \$150 per year. The city's contract with the Milwaukee Gas-Light Company does not expire until next June.

HASTINGS, MINN.—An electric-light plant is assured.

FARIBAULT, MINN.—Natural gas is discovered.

PHILADELPHIA, PA.—The Joint Committees of Councils on Finance and Gas met November 17, to consider a proposition to supply the city with 3,000,000 feet of gas annually in addition to the present capacity of the Philadelphia Gas-Works. No definite action was taken, though a proposition from a manufacturing company to build works at private expense on ground owned by the city was considered. It was stated that the prospective contractors were now furnishing water-gas to New York City and one or two other large cities by what is known as the "Flannery process." There was some opposition offered to immediate action, and the bill was laid over to be printed. It will be more fully considered at a special meeting to be called by the chair.

FREMONT, O.—The Fremont Electric Power Co. will erect a plant.

LOUISVILLE, KY.—The Brush Electric Co., of 328 W. Green Street, will increase their plant.

PITTSBURG, PA.—The contract for lighting the Hoosac Tunnel for the Fitchburg Railway Co. has been awarded to the Westinghouse Electric Co. of this city.

BRANDENBURG, KY.—The Rock Gas Co. will sink a well at once.

ROCKAWAY BEACH, L. I.—A franchise has been granted to Mr. Taylor, of this place, to erect an electric-light plant here.

PORTLAND, ME.—This place has contracted with the Consolidated Electric Light Company for 168 arc lights of 1200 candle-power, and 250 incandescent lights of thirty-two candle-power, for \$26,000 for one year.

STERLING, KAN.—The Sterling Electric Light and Power Company has accepted the proposition of the Archer Electric Manufacturing Company of Wichita, and the work of building and putting up the poles and wires will be begun as soon as possible.

OCALA, FLA.—An electric-lighting plant is to be established here at once.

ASHLAND, KY.—E. M. Roberts has made a proposition to light the city with electric lights. He contemplates erecting the plant.

JACKSONVILLE, FLA.—The Sub-Tropical Exposition Co. are negotiating for the erection of an electric-light plant.

CHATTANOOGA, TENN.—The Brush Electric-Light Company is now busy putting up the ten electric lights, permission for which was granted at the last session of the City Council.

NEW CORPORATIONS.—The Oakland, Cal., Electric Light and Motor Co.; capital stock, \$200,000; James Gamble, Piedmont; Andrew Baird, Berkeley; H. H. Watson, W. W. Blow and I. W. Corder, incorporators.—The Sturgis, Mich., Gas and Electric Light Co. Capital stock, \$120,000. Incorporators, F. B. Ainger and others.—The El Paso

Northwestern Railway and Telegraph Co., capital stock \$300,000, has been chartered to build a railroad about 25 miles long by H. L. Detweiler, Samuel Schultz, and others.—The Jenny Electric Light and Power Co. of Nashville, Tenn., has been incorporated by A. C. Green, W. H. Smith, and others.—The American Automatic Gas Lighting Co., of Portland, Me., has been incorporated; capital stock, \$500,000; Nathaniel H. Shaw, Somerville, Mass., and Hiram G. Farr, 75 Essex St., Boston, Mass., incorporators.—The St. Cloud Gas and Electric Light Co., of St. Cloud, Minn., has been incorporated; capital stock, \$100,000; D. H. Freeman, William Westerman, and others, incorporators.—The Metropolitan Street Lighting Co., of Cincinnati, O., has been incorporated; capital stock, \$50,000; William Glenn, Geo. Fewless, and others, incorporators.—The Sharpville Gas and Oil Co., of Sharpville, Neb., has been incorporated; capital stock, \$7,000.—The Mercer Gas and Fuel Co., of Piqua, O., has been incorporated; capital stock, \$700,000; Geo. H. Smeily, James B. Townsend, and others, incorporators.

STEAM-HEATING, BUILDINGS, ETC.

RALEIGH, N. C.—No contract has as yet been given out for putting heating apparatus in the State buildings. Hot-water or steam-heating will be used and as soon as a decision is made proposals will be made. The matter is in charge of Colonel W. J. Hicks, of this city.

RAILROADS, CANALS, ETC.

JERSEY CITY, N. J.—The Pennsylvania Railroad Co., will construct an elevated railway here, costing \$1,000,000. Address Chas. E. Pugh, General Manager, 233 South Fourth Street, Philadelphia, Pa., for further information.

BOSTON, MASS.—The Boston and New York Railroad announces that it is ready to let the contracts for constructing the new short-line road between New York and Boston. Address Wm. M. Thayer, Secretary, 8 Congress Street, Boston.

THE Third and Trumbull Street Railway Company at Elizabeth, N. J., has been incorporated. Directors elected: A. G. Keasby, Henry Conger, P. A. Van Doren, of Newark, and others.

BIDS OPENED.

BIRMINGHAM, ALA.—The contract for the construction of the water-works system has been awarded to Messrs. W. A. Jeter, of Macon, Ga., and J. M. Cobb, of Beloit.

TUSCALOOSA, ALA.—The contract for construction of water-works system for this place has been awarded to Messrs. Jeter & Boardman, of Macon, Ga.

ANNISTON, ALA.—The contract to erect the city building has been awarded H. H. Boddie.

CHARLESTON, W. VA.—The contract for the erection of the school-house here has been awarded to M. M. M. Buck at \$35,000.

AUBURN, N. Y.—The contract for the stone-work on the new Government building in this city has been awarded to Messrs. Sisson & Ocobock.

CHILLICOTHE, MO.—The contract for the erection of State Industrial Home has been awarded to Messrs. Parks & Glove at \$25,175.

SANTA FE, N. M.—The contract for the erection of Army Hospital at Fort Wingate has been awarded to Messrs. Dobson & Co.

ST. LOUIS, MO.—The Board of Public Improvements has awarded the King Iron Bridge and Manufacturing Company a contract to build the iron-work of the Grand Avenue Bridge across the Mill Creek Valley. The company will receive \$144,000 for the work. The contract requires that the work be completed within ten months.

SYNOPSIS of bids for pumps, engines, pipes, and buildings required for the North Minneapolis, Minn., water-works station, opened by the Committee on Water-Works, at Minneapolis, November 17, and reported by us last week:

Cincinnati-Newport Iron Pipe Company, 12,000 feet 36-inch cast-iron pipe, per ton, \$32.50; Shickle, Harrison & Howard, St. Louis, same amount of pipe, \$30.70; McNeal Pipe and Foundry Co., Burlington, N. J., \$30.69; Lake Shore Pipe Co., Cleveland, \$33; same company, one-half, \$29.70; R. D. Wood & Co., Philadelphia, \$30.50; Dennis Long & Co., Louisville, \$28.40.

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ST. PAUL, MINN.—A new jobbing-house syndicate is being organized, with a capital stock of \$200,000. The company will invest \$22,000 in buildings.

MADISON, WIS.—The contract has been let for the erection of the passenger depot for the Chicago, Madison & Northern, to David Stephens, for \$11,000. This is exclusive of stone and brick, and will make the structure cost altogether about \$20,000.

Building Intelligence.

We solicit from each and every one of our readers information relating to projected buildings in their locality, and should be glad to receive newspaper clippings and other items of interest.

ABBREVIATIONS.—*br* s, brown stone; *br*, brick; *br st*, brick store; *bs dw*, brown-stone dwelling; *apart house*, apartment-house; *ten*, tenement; *e*, each; *o*, owner; *a*, architect; *b*, builder; *fr*, frame.

NEW YORK.

168 W 10th st, br ten; cost, \$21,000; o, Charles Guntzer; a, Wm. Graul.

1st av, w s, 25 s 98th st, 3 br stores and tens; cost, each, \$15,000; o, F. A. Clark; a, E. Wenz.

10th av, s e cor 92d, br church; cost, \$15,000; o, Riverside Baptist Church; a, Edelmann & Smith, B'klyn.

308 W 43d, br flat; cost, \$20,000; o, Henry W Deane; a, M V B Ferdon.

S s 62d, 350 w 9th av, 4 br flats; cost, \$10,000 each; o, Mary E Stafford and others; a, Jas W Cole.

N s 62d, 300 e 11th av, 4 br flats; cost, \$15,000 each; o, Law E Blake; a, Edw Wenz.

BROOKLYN.

Hamilton av. Henry and Luquer sts, br store and ten; cost, abt \$12,000; o, James H. Cross; a, G. Damen.

8th st, n s, 250 e Gowanus canal, br fac (chemicals); cost, \$40,000; o, New York Tartar Co; a, Gaunt & Martinez.

280 and 282 Marion st, s s, 275 e Howard av, 2 fr (br filled) flats; cost, total, \$7,500; o and b, John McDicken; a, E. Dennis.

S w cor Sumner av and Pulaski, 5 br dwells and stores; cost, \$52,000 all; o, Jas Wood; a, Wm Field & Son.

S s 47th, 100 w 4th av, 3 fr dwells; cost, \$7,500 all; o and a, J W French.

E s Schenck av, 300 s Arlington av, 2 frame dwells; cost, \$6,000 all; o, J D Carroll; a, Lamb & Coats.

N e cor Meadow and Morgan av, fr factory; cost, \$11,000; o, L Waterbury & Co; a, F L Hine.

S e cor Central av and Grove, 2 fr dwells; cost, \$10,300 all; o, Jul Dewald; a, not selected.

S s Atlantic av, near Brooklyn av, 2 brick stores; cost, \$5,000 all; o and a, Jas O Carpenter.

N s Troutman, near Hamburg av, 2 frame dwells; cost, \$10,000 all; o, Geo Loeffler; a, Th Engelhardt.

N s Carroll, 109 w 7th av, br church; cost, \$3,000; o, Corporation of the 18th Dutch Church; a, J L Moore.

W s Sumner av, 80 n DeKalb av, br dwell; cost, \$9,000; o, Peter Mangels; a, F Weber.

N w cor 39th and 3d av, br stores and lofts; cost, \$12,000; o, South Brooklyn Railroad Terminal Co; a, A Manur.

S w cor Rockaway av and Herkimer, 2 br dwells; cost, \$10,000 all; o, Rich Robbins; a, Wm Godfrey.

S s Herkimer, 20 w Rockaway av, 8 brick dwells; cost, \$20,000 all; o and a, same as above.

W s Page av, 300 w Greenpoint av, br store and dwell; cost, \$8,000; o, Sorce & Fleming Mfg. Co.

S s Carroll, 406 e 8th av, frame dwell; cost, \$9,100; o, F W Dauch; a, W B Tubby.

S s Carroll, 406 e 8th av, brick dwell; cost, \$10,400; o, E N Ford; a, same as above.

S s Carroll, 355 e 8th av, br dwell; cost, \$8,434; o, W H Hagen; a, same as above.

S s Carroll, 346 e 8th av, brick dwell; cost, \$10,000; o, Martin & Lee; a, same as above.

S s Carroll, 386 e 8th av, brick dwell; cost, \$7,774; o, E H Sayre; a, same as above.

N s Jefferson av, 75 w Stuyvesant av, 4 br tens; cost, \$15,000 all; o, E H Bishop; a, not given.

S s Grove st, 285 w Central av, 2 fr dwells; total cost, \$7,500; o, P McEntes; a, E Dennis.

N s Wallabout st, 150 e Wythe av, brick factory; cost, \$8,000; o, David Brown; a, W. H. Gaylor.

N w cor St Mark and Bedford av, br dwell and store; cost, \$12,000; o, A C Brownell; a, F K Iwing.

W s Central av, 25 s Palmetto st, 2 frame dwells; total cost, \$18,000; o, Kaiser & Vall Lord; a, F Tholmburg.

E s Hicks st, 250 s Rapelyea st, br dwell; cost, \$7,000; o, Mary E Lynch.

N s Clifton Place, 300 e Grand, 6 br dwells; total cost, \$72,000; o, Thos H Brush; a, J G Glover.

MISCELLANEOUS.

MILWAUKEE, WIS.—The county committee on insane asylum of the board of supervisors at a recent meeting decided to recommend the appropriation of \$60,000 to be used in erecting an addition to the Wauwatosa insane asylum.

CHICAGO, ILL.—A large \$60,000 hall will be erected at Noble & Blackhawk sts by Andrew Schultz; a, Theo. Lewandowski can give details.

OMAHA, NEB.—George Hammond can give details of large packing houses to be erected in this city soon.

WICHITA, KAN.—The plans for the main building of the Sisters' Academy in West Wichita will be submitted to the contractors in a few weeks.

HARRISON, NEB.—This town has voted to invest \$10,000 in a court-house and present it to Sioux County.

COLUMBIA CITY, IND.—Chauncey B. Mattoon will give particulars of the new court-house to be erected in this city.

ST. PAUL, MINN.—West St Paul is to have a school house which will be the largest in the city. It will cost \$50,000.

DAYTON, O.—No buildings over \$7,000 to report.

PROVIDENCE, R. I.—Nine permits have been issued for new buildings to cost less than \$7,000 each.

BALTIMORE, MD.—Cor Benson and Decatur, church; o, Ger Luth Church.

15 Stricker, near Tennant 3 story br bldg; o, C A Pindell.

CHICAGO, ILL.—The President of the Wisconsin Central Railway states that it is the intention of the company to expend about \$1,000,000 in the erection of depots in this city in the near future. The new depots, he says, will be after the English style of architecture.

CONCORD, N. H.—A Committee of the Trustees of the New Hampshire College of Agriculture and Mechanic Arts has voted to build and equip a building for instruction in mechanic arts at Hanover.

BUCKHANNON, W. VA.—A seminary to cost \$20,000 will be built. Rev L H Jordan can give details.

WARRENSBURG, MO.—This city will vote February 21 on a proposition to build a court-house to cost \$60,000.

PITTSFIELD, MASS.—St. Stephen's parish will build a new church on the site of the present edifice; Dr. Adams, Eugene Robbins and C. E. Merrill were appointed a committee to procure plans for a \$30,000 church.

KANSAS CITY.—417 Walnut, 3-story store; cost, \$20,000; o, Stranahan & Baker; a, H B Prudden; b, Geo. Youmans.

109 bldgs costing less than \$7,000.

PHILADELPHIA.—Woodland av, w 69th, hospital bldg.

Also 71 fr structures.

ALLEGHENY, PA.—The High School Committee of this city has decided to erect a new high school building. Major A. J. Pentecost is one of a committee on heating apparatus for the building, and James T. Steer is the architect. Bids will be asked for at once.

SUMMIT, N. J.—W H Deforest knows about a music-hall to be erected here.

LINCOLN, NEB.—Ed A Church can give information concerning an opera-house to be erected here; cost, \$100,000.

DECATUR, ALA.—Write to P J O'Brien, of Birmingham, for details of an opera-house to be erected in this city; cost, \$100,000.

SANTA FE, N. M.—Dobson & Co have been awarded the contract for the erection of the Army Hospital at Fort Wingate.

ST. PAUL, MINN.—The Central Presbyterian Church will build; outlay, \$60,000; R P Lewis, Gates R Johnson, and others, committee on plans.

OMAHA, NEB.—This city has voted issuance of \$200,000 in bonds for the purchase of eight school sites and the erection of five new buildings; also permission to build a \$50,000 addition to the High School and erect a new school building costing \$25,000.

CHATTANOOGA, TENN.—The Cincinnati Investment Co will erect 19 brick store-houses, at a cost of about \$100,000. W H Floyd has been engaged as architect and superintendent.

MARINETTE, WIS.—Work has been begun on Isaac Stephenson's mammoth new saw-mill on Tweedie Island, which will cost over \$150,000, and will have a daily capacity of 125,000 feet.

ST. PAUL, MINN.—View, near Juno, brick veneer church; cost, \$16,000; o, St James Parish.

Westminster, near Waverly, 25 to blk fr dwell; cost, \$10,000; o, J Smith.

25 minor permits, \$30,000.

PORTLAND, ORE.—The Willamette Valley and Coast Railway Co will build an elevator here costing \$15,000. Address F C Buell, Corvallis, Ore.

WORCESTER.—Nothing of \$7,000 to report this week.

YOUNGSTOWN, O.—Nothing over \$7,000 to report, but about 20 bldgs less than \$7,000 are being erected here.

LAMAR, MO.—Our correspondent writes: "The people by special vote have authorized the County Court to levy a special tax to build Court-house, and the County Court has set the first Monday in December to select plans for Court-house."

HARRISBURG, PA.—No new work over \$7,000 in value to report this week.

LOWELL, MASS.—Dutton st, 3-story br mill; o and b, E G Baker.

Pawtucket st, addition to the Lowell Hospital; b, C H Nelson.

TILTON, N H.—A new hotel is proposed.

PORTSMOUTH, N H.—Eldredge Brewery is to have a tower 125 feet high.

NEWPORT, N H.—Apparatus for manufacturing water-gas is being put into the shoe factory.

BERLIN, N H.—The streets and stores are to be lighted by 40 arc lights.

BUFFALO, N Y.—Building to the amount of \$13,000 is going on here this week.

McKEESPORT, PA.—The officials of the Pittsburgh, McKeesport and Youghiogheny Railroad Company are negotiating for the purchase of a 300-foot square plot of ground for the purpose of having constructed a large passenger and freight depot.

DECATUR, ALA.—The contract for the erection of the shops of the Louisville and Nashville Railroad at this place has been awarded to Morris & Newman, of Indianapolis. The works will comprise fourteen buildings from 180 to 280 feet each in length.

The contract for the erection of the car-wheel and car-spring manufactory has been awarded to Turner & Goodwin. There will be several buildings, the main one to be 80 x 275 feet. The works will be in operation by January 1, 1888, and will turn out 100 car wheels a day.

TOLEDO, OHIO.—S H Keeler can give details of hospital to be built here soon.

WICHITA, KAN.—The Sedgwick Co. will build a new jail.

CHICAGO, ILL.—3404 Forest av, br dw; cost, \$17,000; o, Mrs W M Wolff; a, F Alschlager; b, Gutrich Bros.

311 Division, br store and flats; cost, \$10,000; o, C F Bilhorn; a, J Hogue, Jr; b, M Zappich.

742-44 Van Buren, br store and flats; cost, \$11,500; o, Jno Hollowell; a, J J Donnellan; b, M J Benson.

7-11 Barton pl, br flats; cost, \$14,000; o, H Wedemeyer; a, E Bauman; b, Lotz & Thompson.

631-23 Wells, br school; cost, \$17,000; o, German-English school; a, Theo Karls; b, U Garten.

370 W Randolph, br store and flats; cost, \$10,000; o, J F Farnsworth; a, W H Drake; b, Tobin & Raycroft.

726-36 W Taylor br flats; cost, \$50,000; o, Copeland & McSorley; a, H S Jaffray; b, owner.

1302-12 W Adams, br dw; cost, \$17,000; o, a, and b, W J Anderson.

486 W Congress, br dw; cost, \$12,000; o, P H Fitzpatrick; a, L M Beers; b, Thos Keating.

51 Delaware pl br dw; cost, \$12,000; o, Geo S Morrison; b, Jos Downey.

Wells and Division, br store and flats; cost, \$17,000; o, Hy Hotchkiss; a, Fromann & Jeben; b, Wm Soeffker.

1-3 Hamilton av, br dw; cost, \$12,000; o, N R Wakefield; a, E Pierce; b, A Kaiser.

3272-78 Archer av, br elevator; cost, \$30,000; o, Geo A Seaverns; a, Jno Doble; b, Bristol & Smith.

614 W Harrison, br store and flats; cost, \$8,000; o, Herman Bros; a, J Warner; b, E J Hayes.

12-18 California av, br dw; cost, \$15,000; o, J L Campbell. a, C A Weary; b, F N Townsend.

735-53 Shober, br flats; cost, \$17,000; o, a, and b, Jno Jansen.

82-84 Wells, br store and flats; cost, \$17,000; o, Fogarty & Hudson; a, Treat & Foltz; b, Halls & Worth.

BOSTON.—63 and 65 Essex, br stores; cost, \$35,000; o, Alpheus Hardy; a, Cummings & Son; b, James Smith.

Centre nr Burroughs, Jamaica Plain, br dw; cost, \$8,000; o, Michael F Dolan; a, W Henry Winslow; b, James McNeal.

Centre nr Burroughs, br apartment; cost, \$8,000; o, a, and b, Wm Rooney.

CHATTANOOGA.—At east end city of Chattanooga, Tenn., foundry, \$6,500; warehouse, \$7,400; 2-story factory bldg, \$4,500; 3 1-story factory bldgs, cost each, \$3,100; o, Anson T Wood Mower & Reaper Co; a, Thomas Sully.

WARRENSBURG, MO.—The county commissioners have erected a court house here; cost, \$60,000.

ST. LOUIS, MO.—3d and Pine sts, br restaurant; cost, \$18,000; o, J Giradi; a, J S Taylor; b, B. Weber & Co.

Sarah and Washington avs, br dwell; cost, \$8,000; o, W. H. Boone; a, Thayer & Co; b, W. H. Boone.

Olive st and Cabanne av, br flat; cost, \$7,500; o and a, J B Legg; b, S L Jones.

Osage and Iowa avs, 2 adj br dwells; cost, \$9,000; o, Mrs A Geniener; b, F Miller.

17th and Franklin av, br store and dwell; cost, \$14,000; o, S Simmons; a, F Mortimer; b, F C Bonsack.

KANSAS CITY.—S w cor Grove and 16th st, 3-story br dwell; cost \$25,000; o, Aug Koch.

22d st and Park av, 2 story br dwell; cost, \$9,000; o, C E Cooper.

N w cor Ind and Grand avs, 3 br stores; cost, \$25,000; o, J S Reber.

93 bldgs costing less than \$7,000.

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